08119

User's Guide

TestPad 2000™

T1/T3 Field Services Module

ACTERNA™
The Keepers of Communications

Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_13318

50-15389-01
Rev. F

TESTPAD 2000™
T1/T3 FIELD SERVICES MODULE
USER'S GUIDE

August 2001

ACTERNA™
The Keepers of Communications

Copyright © 2001 Acterna
20400 Observation Drive, Germantown, Maryland 20876
USA 1-800-638-2049 • +1-301-353-1550 • FAX +1-301-353-0234
www.acterna.com

Notice

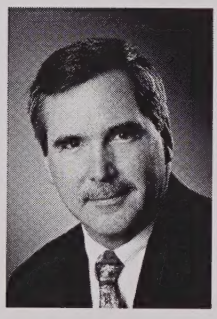
Specifications, terms, and conditions are subject to change without notice.
All trademarks and registered trademarks are the property of their respective companies.

CE Compliance Information

The Acterna TestPad 2000 is marked CE compliant; however, when the 2209 T1/T3 Field Services Module is connected to the test pad, the Acterna TestPad 2000 is not CE-compliant.

Dear Acterna Customer,

Thank you for selecting an Acterna product from our extensive family of communications test solutions. We appreciate your business and look forward to a continuing relationship with you as your network grows and your networking needs change.



For more than two decades, Acterna has designed, manufactured, and marketed industry-leading test products that improve our customers' network performance. Acterna's mission is to develop the most technologically advanced, easy-to-use instruments, systems, and software for improved network installation and maintenance.

We stand behind our family of products. To support our products throughout the world, we provide a comprehensive program of full technical support, technology and product training, and professional services. We offer network consulting services, on-site applications assistance, software customization, test procedure development, network management services, technical product support, and much more.

Our team of professionals is ready to assist you with your new product so that it fully meets your network testing demands. Contact us today at one of the numbers found on the attached Acterna Contact List or visit our Website at www.acterna.com to learn more about how we may serve you.

Thank you again for choosing an Acterna product.

Sincerely,

John Peeler

John Peeler
President and CEO

Acterna Worldwide Contacts

Organization	Contact
Acterna Headquarters	20400 Observation Drive Germantown, Maryland 20876-4023 USA Toll-free: 1-800-638-2049 In Maryland: 1-301-353-1550 Fax: 1-301-353-0731 Web: www.acterna.com *Technical Assistance Center (TAC), for technical questions* Toll-free: 1-800-638-2049 Phone: 1-301-353-1560, ext. 2300/2301 Fax: 1-301-353-1239 Email: tac@acterna.com *Customer Care Center (CCC), for product repair and orders* Toll-free: 1-800-638-2049 Phone: 1-301-353-1560, ext. 2850 Fax: 1-301-353-9216 Email: isc@acterna.com (instrument repair) custserv@acterna.com (customer service) *Technical Training, for product/technology training* Toll-free: 1-800-638-2049, ext. 2131 (USA East) Phone: 1-714-680-3004, ext. 592 (USA West) Fax: 1-301-353-0731
Acterna Asia Pacific Ltd.	Room 4205, Tower II, Metroplaza 223 Hing Fong Road, Kwai Chung New Territories, Hong Kong Phone: 011 852 2892 0990 Fax: 011 852 2892 0770
Acterna Australia, Melbourne	41 Stamford Road Oakleigh, 3166 Victoria, Australia Phone: 011 61 3 9563 4800 Fax: 011 61 3 9563 4900
Acterna Australia, Sydney	Suite 3, Level 12 100 Walker Street North Syndney. 2060 NSW, Australia Phone: 011 61 2 9926 1447 Fax: 011 61 2 9460 0101

Acterna Worldwide Contacts (Continued)

Organization	Contact
Acterna Benelux (Belgium)	Battelsesteenweg 455E 2800 Mechelen, Belgium Phone: 011 32 1528 7686 Fax: 011 32 1528 7687
Acterna Canada, Toronto Office	234 Matheson Boulevard East Mississauga, Ontario L4Z 1X1, Canada Toll-free: 1-888-689-2165 Phone: 1-905-507-4117 or 4118 Fax: 1-905-507-4126
Acterna Canada, Vancouver Office	3665 Kingsway, Unit 300 Vancouver, B.C. V5R 5W2, Canada Phone: 1-604-436-0855 Fax: 1-604-439-6714
Acterna Canada, Montreal Office	Acterna Canada Ltd. 4150, boul.Saint-Martin Quest Laval, (Quebec), H7T 1C1, Canada Phone: 1-450-688-6069 Fax: 1-450-688-5242
Acterna China	Acterna Beijing Room 402, Qing Au Building No. 27, Xiao Yun Road Chaoyang District Beijing 100027, China Phone: 011 86 10 6460 5258 Fax: 011 86 10 6460 5256
Acterna France	Division of Dynatech Communications Batiment GAIA 9, Parc Ariane 78284 Guyancourt Cedex, France Phone: 011 33 1 30 48 83 90 or 00 Fax: 011 33 1 30 48 06 46

Acterna Worldwide Contacts (Continued)

Organization	Contact
Acterna Germany, Frankfurt Office	Acterna Deutschland Max-Planck-Str. 22 61381 Friedrichsdorf, Germany Phone: 011 49 6172 5911 00 Fax: 011 49 6172 72065
Acterna Germany, Munich Office	Acterna Deutschland Riemer Str. 358 81829 Muenchen, Germany Phone: 011 49 89 907874 Fax: 011 49 89 907087
Acterna United Kingdom	Acterna (UK) Ltd. Marlborough House 3-5 Worton Drive Worton Grange Reading, Berks RG2 OTG, United Kingdom Free Phone: 800 882 85822, Europe Phone: 011 44 1189 759696 Fax: 011 44 1189 227200 Email: eurotac@acterna.com

TABLE OF CONTENTS

Section	Description	Page
	Acterna Worldwide Contacts	**2-iv**
1	**GETTING STARTED**	**1-1**
1.1	Welcome to the TestPad™ 2000 T1/T3 Field Services Module	1-1
1.2	Manual Overview	1-1
1.3	Options	1-2
1.4	Instrument Description	1-4
1.4.1	*Front-Panel Features*	*1-5*
1.4.2	*Bottom-Panel Features*	*1-6*
1.4.3	*Top-Panel Features*	*1-7*
2	**OPERATION**	**2-9**
2.1	User Interface Description	2-9
2.1.1	*Results Category Descriptions*	*2-14*
2.1.2	*Additional Test Results*	*2-18*
2.2	Application Setup Property Sheets	2-19
2.3	Using the 2209 module	2-20
2.4	Battery Operation	2-23
2.4.1	*Battery Installation and Replacement*	*2-23*
2.4.2	*Battery Charging*	*2-24*
3	**COMMON APPLICATIONS**	**3-25**
3.1	Monitoring T1 Performance	3-25
3.2	T1 Loopback BER Test	3-27
3.3	T1 Loopback Test From a DSX-1	3-29
3.4	Monitoring A/B/C/D Signaling Bits	3-32
3.5	Monitoring Fractional HDLC Statistics	3-33
3.6	Monitoring VF	3-36
3.6.1	*Signal-To-Noise Ratio Measurements*	*3-37*
3.7	Transmitting VF Tones from a DSX-1	3-39
3.8	In-Service DS1 Timing Slips Analysis	3-40
3.9	CSU Emulation	3-42
3.10	Signaling Monitor (Call Capture)	3-46
3.11	PBX/Switch Emulation (Originating a Call)	3-48
3.12	PBX/Switch Emulation (Terminating a Call)	3-51
3.13	T1 Drop and Insert Setup (Place Call)	3-52
3.14	Testing Intelligent Repeater Spans	3-55
3.15	Using VT100 Emulation	3-60

TABLE OF CONTENTS

Section	Description	Page
3.16	Using TestMATE	3-64
3.17	Using TestPad Intelligent Test	3-64
3.17.1	*TestPad Intelligent Test Configuration*	*3-65*
3.18	User Configured Test	3-70
3.18.1	*User-Configured Test Configuration*	*3-71*
3.19	Using a PCMCIA Card with TestMATE	3-77
3.19.1	*Saving Tests on a PCMCIA Card*	*3-77*
3.19.1.1	Sample TestMATE Configuration File	3-77
3.19.2	*Adding Descriptive Comments to a User-Configured Test*	*3-80*
3.19.3	*Saving Results on a PCMCIA Card*	*3-82*
3.20	DS3 Loopback BER Test	3-83
3.21	DS1 Monitor Test from DS3	3-85
3.22	User-Programmable Loop Codes and Patterns	3-88
3.22.1	*Programmable Code Configuration*	*3-88*
4	**ISDN PRI OPTION**	**4-93**
4.1	Introduction	4-93
4.2	Specifications	4-93
4.3	Functional Applications	4-94
4.4	Monitor Mode for ISDN PRI Calls	4-94
4.5	Terminate Mode for ISDN PRI Calls	4-97
4.6	Supported Features of Terminate Mode PRI	4-98
4.6.1	*Place Call and Receive Call*	*4-98*
4.6.2	*NFAS Capability*	*4-101*
4.6.3	*D-Channel Backup Testing*	*4-103*
4.7	ISDN Property Sheets And Menus	4-104
4.7.1	*ISDN Setup Property Screen*	*4-104*
4.7.2	*ISDN PRI Test Type Setup Screen Description*	*4-105*
4.8	ISDN PRI Call Settings Menu	4-106
4.8.1	*ISDN PRI Call Type Screen Description*	*4-106*
4.9	Placing An ISDN PRI Call to TPI 560P	4-108
4.10	ISDN PRI Test Results	4-108
4.10.1	*ISDN PRI Status Messages*	*4-110*
4.10.2	*ISDN PRI Cause Codes*	*4-111*
5	**Printer Operation**	**5-115**
5.1	Introduction	5-115
5.2	Printer Setup	5-115
5.2.1	*Printer Connection*	*5-115*

TABLE OF CONTENTS

Section	Description	Page
5.2.2	*Printer Access Control*	*5-115*
5.3	Printer Property Sheet	5-116
5.3.1	*Print Request Tab*	*5-116*
5.3.1.1	Results Print	5-116
5.3.1.2	Controls Print	5-117
5.3.1.3	Clear Buffer	5-117
5.3.1.4	Abort Printout	5-117
5.3.2	*Printer Settings Tab*	*5-117*
5.3.3	*Print Options Tab*	*5-118*
6	**Specifications**	**6-119**
6.1	General Specifications	6-119
6.1.1	*Physical Characteristics:*	*6-119*
6.1.2	*Environmental Characteristics:*	*6-119*
6.1.3	*Electrical Characteristics:*	*6-119*
6.2	DS1 Specifications	6-119
6.2.1	*Input Specifications*	*6-119*
6.2.1.1	RX Jack	6-119
6.2.1.2	Loop Codes Detection Criteria	6-120
6.2.1.3	Pattern Synchronization Detection Criteria	6-120
6.2.2	*Output Specifications*	*6-120*
6.2.2.1	TX Jack	6-120
6.2.2.2	Transmitted Loop Codes	6-121
6.2.3	*Measurements Specifications*	*6-121*
6.2.4	*Alarm Criteria*	*6-122*
6.3	DS3 Option Specifications	6-123
6.3.1	*DS3 Specifications*	*6-123*
6.3.1.1	Framing Formats	6-123
6.3.1.2	Patterns	6-123
6.3.1.3	Line Coding	6-123
6.3.1.4	Connectors	6-123
6.3.1.5	Receiver (Single)	6-123
6.3.1.6	Transmitter (Single)	6-123
6.3.2	*DS3 Measurements*	*6-124*
6.3.2.1	Summary	6-124
6.3.2.2	Logic	6-124
6.3.2.3	Bipolar Violations	6-124
6.3.2.4	Frame Errors	6-125
6.3.2.5	Parity	6-125

TABLE OF CONTENTS

Section	Description	Page
6.3.2.6	Signal	6-125
7	**Acterna Customer Services**	**7-127**
7.1	Introduction	7-127
7.2	Customer Service Locations	7-127
7.3	Services	7-127
7.3.1	*Instrument Service*	*7-127*
7.3.2	*Product Enhancement Group*	*7-128*
7.3.3	*Test Systems Field Engineering and Installation*	*7-129*
7.3.4	*Technical Training*	*7-129*
7.4	Warranty Information	7-130
7.4.1	*Hardware Warranty*	*7-130*
7.4.2	*Software Warranty*	*7-130*
7.4.3	*Services Warranty*	*7-131*
7.4.4	*WARRANTY DISCLAIMER*	*7-131*
7.5	Equipment Return Instructions	7-132
	Index	**8-133**

LIST OF FIGURES

Figure	Description	Page
1-1	Acterna TestPad 2000 and the 2209 T1/T3 Field Services Module	1-4
1-2	Front Panel	1-5
1-3	Bottom Panel	1-6
1-4	Top Panel	1-7
2-1	Main Screen	2-9
2-2	Application Icons with Pull-Down Lists	2-10
2-3	Sample Configuration/ACTION Button Usage	2-12
2-4	Results GROUP/CATEGORY Selection on Main Menu Screen	2-12
2-5	Dual Test Results Display	2-13
2-6	Pull-Down List in Results CATEGORY	2-14
2-7	Setup Summary Property Sheet	2-19
2-8	Property Sheet Tabs Set Test Parameters	2-20
2-9	Choosing an Application	2-21
2-10	Property Tabs Behind Summary Sheet	2-22
3-1	Monitoring VF Test Setup	3-37
3-2	Typical Signal-to-Noise Ratio Results Screen	3-38
3-3	DS1 Timing Slips Analysis	3-42
3-4	Simulation Drop and Insert Setup	3-54
3-5	DS3 Loopback BER Test	3-84
3-6	DS1 Monitor From DS3 Test	3-87
4-1	Monitor ISDN PRI Test Setup	4-94
4-2	Monitor ISDN PRI Setup Screen	4-95
4-3	ISDN PRI Terminate Mode	4-97
4-4	Samples of ISDN Call and Call Type Property Sheets	4-100
4-5	ISDN PRI Call Control Keypad	4-101
4-6	NFAS/DCBU Property Sheet Set Parameters	4-102
4-7	ISDN Status CATEGORY for D-Channel Test	4-103
4-8	ISDN PRI Summary Screen	4-104
4-9	ISDN PRI Setup Screen	4-105
4-10	ISDN PRI Call Settings	4-106
4-11	ISDN PRI Call Setting Pop-up Dialog Box	4-107
4-12	ISDN PRI Result Screens	4-109
5-1	Print Request Property Sheet Tab	5-116
5-2	Printer Settings Property Sheet Tab	5-117
5-3	Print Options Property Sheet Tab	5-118

LIST OF FIGURES

Figures Description Page

LIST OF TABLES

Table	Description	Page
1-1	Front-Panel Features	1-5
1-2	Bottom-Panel Features	1-7
1-3	Top-Panel Features	1-8
2-1	Permanent Softkey Icons	2-11
2-2	Logic Results	2-14
2-3	BPV Results	2-15
2-4	Frame Results	2-15
2-5	Signal Results	2-17
2-6	Traffic Results	2-18
2-7	Time Results	2-18
3-1	Fractional HDLC Results and Range	3-35
3-2	Signal-To-Noise Ratio Results	3-38
3-3	Repeater Commands for Loop Code Tests	3-59
3-4	Description of File Headings	3-79
3-5	Description of Configuration Variables	3-80
3-6	Description of Comment Item Variables	3-81
4-1	ISDN Option Specifications	4-93
4-2	ISDN PRI Call Specifications	4-99
4-3	ISDN PRI Config Call 1/Call 2 Property Sheet	4-100
4-4	D-Channel States and Descriptions	4-104
4-5	Test Results Categories for ISDN PRI	4-110
4-6	ISDN PRI Status Messages	4-110
4-7	Cause Codes	4-111
4-8	National-Specific Cause Codes	4-112

LIST OF TABLES

Table	Description	Page

SECTION 1 GETTING STARTED

1.1 WELCOME TO THE TESTPAD™ 2000 T1/T3 FIELD SERVICES MODULE

The TestPad 2000 T1/T3 Field Services Module (2209) is the latest product offering for our Acterna TestPad 2000 platform, whose ease-of-use, flexibility, and upgradability has established the next generation in test instruments. The 2209 T1/T3 Field Services Module combines graphical user interface technology and a touch-sensitive screen to simplify test setup and reduce test configuration time. The innovative icon-driven interface is easy to learn, and the large display screen provides ample space for displaying test results.

The 2209 module provides you the necessary test capabilities for quick, comprehensive installation and fault isolation of DS1 and DS3 transmission systems. Features include:

- Dual-receiver in-service monitoring of both the transmit and receive signals simultaneously.
- Advanced timing analysis for determining signal delays or mismatches between the switch and remote equipment.
- Isolation of physical-layer problems associated with data or other advanced service offerings for a single channel without taking unaffected channels out of service.

1.2 MANUAL OVERVIEW

This manual is organized to help you quickly become familiar with the 2209 and its capabilities. This manual is divided into the following sections:

1. **Getting Started** — includes welcome statement, manual overview, and instrument description.
2. **Operation** — provides an explanation of the application module design, a description of the graphical user interface, and information on battery charging and replacement.
3. **Common Applications** — describes several 2209 standard applications. Each application describes how to configure the 2209, connect to the circuit being tested and interprets the test results.
4. **ISDN PRI Application** — describes ISDN applications, test setups, and results.
5. **Printer Operation** — presents information on connecting the 2209 to a serial printer to provide test setup and test results printouts.
6. **Specifications** — includes the physical, environmental, and electrical specifications for the instrument.

7. **Acterna Customer Services** — includes information on the wide range of customer care, technical support, instrument maintenance, training services, plus warranty and service information.

NOTE

Acterna has application notes and technical notes available upon request and our Website www.acterna.com has the latest information and answers to your questions.

1.3 OPTIONS

The following options are available for the 2209 T1/T3 Field Services Module.

Advanced Stress Patterns Option

This option enables you to transmit and receive fixed long patterns beyond the standard patterns offered in the test set. The seven T1 stress patterns are designed to stress test the timing recovery circuits and span-line repeater ALBO circuitry. The patterns include: T1-DALY, 55 octet, 2-96, 3-54, 4-120, 5-53, and MIN/MAX.

Fractional T1 Option

This option provides Fractional-T1 (FT1) modes for contiguous and noncontiguous, 56KxN and 64KxN, channel formats. This option enables complete qualification and testing of new FT1 circuits before connecting customer premises equipment. The V.54 FT1 loop code is also added to the feature list and allows for single test set testing of FT1 circuits from a convenient T1 access point.

VF PCM TIMS Option

This option provides the ability to listen to PCM encoded signals through the built-in speaker and non-intrusively monitor those signals with the two T1 receivers. In addition, it allows you to measure VF tone frequency and level as well as transmit tones (Quiet, 404 Hz, 1004 Hz, 2804 Hz, and 2713 Hz) on an individual PCM channel basis. The option allows for variable frequency/level tones to be transmitted as well. Noise measurements including SNR, C-Message, and C-Notch are also features of this option.

Signaling Option

This option enables you to test the ability of a switch/PBX to handle incoming calls and allows you to emulate switch-to-switch communications. The option allows you to place, receive, and monitor calls over several trunk types. Features include: Send/receive DTMF digits to/from switches and PBXs. Dial-up and test VF circuits. Measure inter-digit delay and digit/tone duration.

Fractional HDLC Option

This option allows you to gather frame-level statistics on any HDLC-based transport such as SS7, Frame Relay, or ISDN. It tests and loops contiguous and non-contiguous fractional T1 bandwidths on 56KxN and 64KxN channel formats.

DS3 Analysis Option

This option adds DS3 testing to the already extensive DS1/DS0 testing capabilities of the 2209. Without adding any size to the existing test set, this option lets you qualify DS3 circuits with BERT patterns for both M13 and C-bit framing; insert patterns on one or all DS3 channels; and drop DS1 and DS0 channels from DS3 signals to test and monitor, and verify frame synchronization on DS3 lines.

Primary Rate ISDN Option

This option adds Primary Rate ISDN testing capabilities, including the ability to place/receive multiple voice/data calls, test D-channel backup, support NFAS, and monitor via D-channel decodes. Supports AT&T 5ESS, NT DMS100, and NI-2 call controls. Supports multiple call types including voice,56K, 64K, Nx64, Nx56, and H0.

Intelligent Line Equipment Option

This option provides the ability to loop up and loop down individual addressable office repeaters and line repeaters or to transmit maintenance switch commands. Supported equipment includes those from Westell and Teltrend.

VT100 Emulation Option

This option enables you to switch the 2209 from a BER test instrument to a VT100 terminal. Users can monitor or provision network elements such as Performance Monitoring NIUs, or HDSL terminal units via a direct RS-232 connection from the 2209.

TestMATE Option

This option adds enhanced intelligence testing capabilities for T1 turn-up tests. It enables auto-configuration setup, auto-testing, and results interpretation for T1 qualification tests. It also includes real-time tutorial components in a text-sensitive help guide.

1.4 INSTRUMENT DESCRIPTION

The 2209 T1/T3 Field Services Module is a hand-held test set that is designed around the powerful and flexible Acterna TestPad 2000 architecture, which includes a touch-sensitive screen that supports various application modules. The modular design enables the TestPad 2000 to easily convert from one test technology to another.

The modular design includes two 1/4-turn screws (counterclockwise to release; Clockwise to secure) on the side of the application module for simple release and swapping (see Figure 1-1). The 2209 also comes with a hand strap that can be mounted on either side of the unit (on the TestPad or application module).

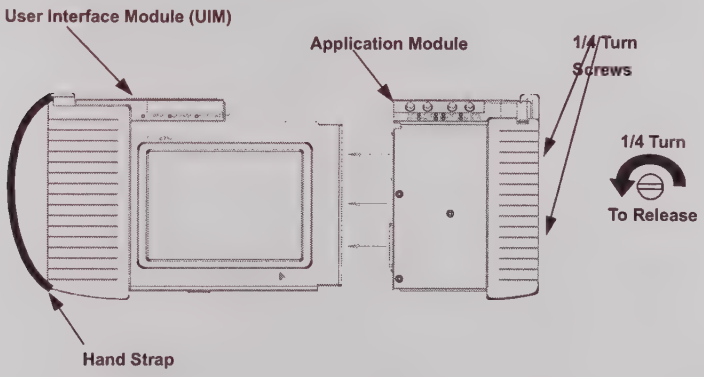


Figure 1-1. Acterna TestPad 2000 and the 2209 T1/T3 Field Services Module

1.4.1 Front-Panel Features

The 2209 module provides two transmitters and receivers for T1 circuit analysis and a touch-sensitive Liquid Crystal Display (LCD) for test configuration and results selection (see Figure 1-2).

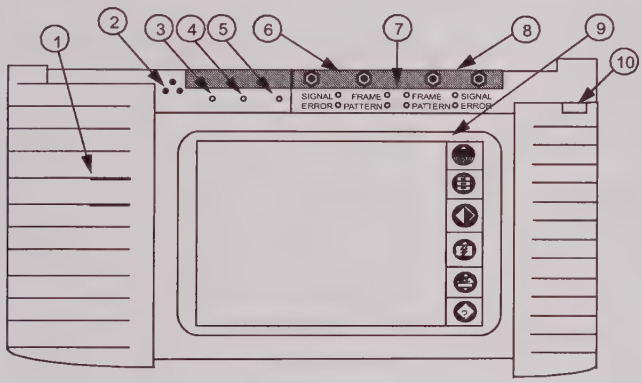


Figure 1-2. Front Panel

Table 1-1 describes front-panel features.

Table 1-1. Front-Panel Features

#	Item	Description
1	Speaker	Provides audio output for active voice calls.
2	Microphone	Enables you to talk when a talk path is required. A "Push 2 Talk" button appears on the LCD. As an alternative, you can use a handset (supplied).
3	Power LED	Illuminates when power is supplied either from the battery or AC power adaptor.
4	Charging LED	Illuminates when the battery is charging.
5	Battery Low LED	Illuminates when only 25% of battery power remains. Use the AC power adaptor to recharge the battery and continue testing.
6	Primary RX & TX Jacks	Bantam jacks used to supply the T1 connection to the primary receiver and transmitter. Used for most operations.

Table 1-1. Front-Panel Features (Continued)

#	Item	Description
7	Status/Alarm LEDs	Divided into two sets that coincide with the Primary or Secondary RX and TX jacks. **Status LEDs** — illuminates green to indicate Signal Present, Frame Sync, and Pattern Sync. **Error LED** — illuminates red to indicate a signal problem. Go to the Summary category to view errors.
8	Secondary RX & TX Jacks	Bantam jacks used to supply the T1 connection to the secondary receiver and transmitter. Used for dual monitor and Drop and Insert (D&I) applications.
9	LCD	Touch-sensitive screen divided into separate areas for test configuration and test results display. Refer to Section 2 for a detailed description of the LCD and how it works.
10	Stylus Slot	Use stylus with the touch-sensitive LCD. When not in use, the stylus should be stored in the stylus slot. The stylus is not mandatory to operate the unit; any blunt pointer including your finger can be used.

1.4.2 Bottom-Panel Features

The 2209 bottom panel provides the **Power** switch, AC adaptor plug, handset jack, and battery access panel (Figure 1-3).

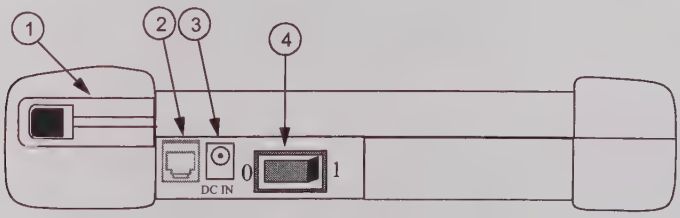


Figure 1-3. Bottom Panel

Table 1-2 describes the Power switch and other features on the bottom of the test instrument.

Table 1-2. Bottom-Panel Features

#	Item	Description
1	Battery Access Door	Provides access to the rechargeable battery.
2	Handset Jack	Allows the supplied handset to be connected to the unit and establish a talk path.
3	Adaptor Plug	18 VDC connector for the AC power adaptor.
4	Power Switch	Turns the test set on and off.

1.4.3 Top-Panel Features

The top panel provides the printer connection, dual-PCMCIA card door/slot, and DS3 jacks and status LEDs (Figure 1-4).

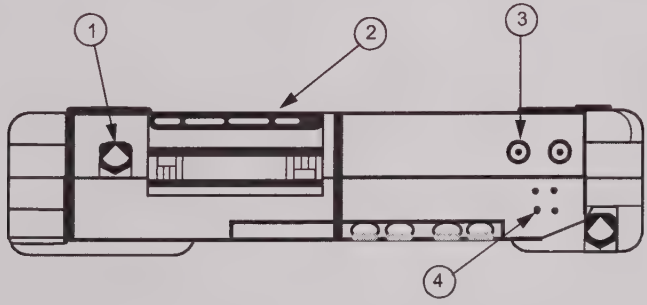


Figure 1-4. Top Panel

Table 1-3 describes features on the top panel of the 2209 module.

Table 1-3. Top-Panel Features

#	Item	Description
1	Printer Connector	Provides connection for a serial printer (Acterna PR-40A) for printing test configurations and results. Also used for optional VT100 emulation option if installed.
2	Dual-PCMCIA Card Door/	Allows for software upgrades via two Type II PCMCIA cards or one Type III PCMCIA card.
3	DS3 Rx and Tx Jacks	Connectors available with the 2209 DS3 Option.
4	Status/Alarm LEDs	LEDs available with the 2209 DS3 Option

SECTION 2 OPERATION

2.1 USER INTERFACE DESCRIPTION

When you activate the 2209 T1/T3 Field Services Module, it displays the main screen (see Figure 2-1). The main screen is used to provide setup and configuration data and to display test-specific action buttons.

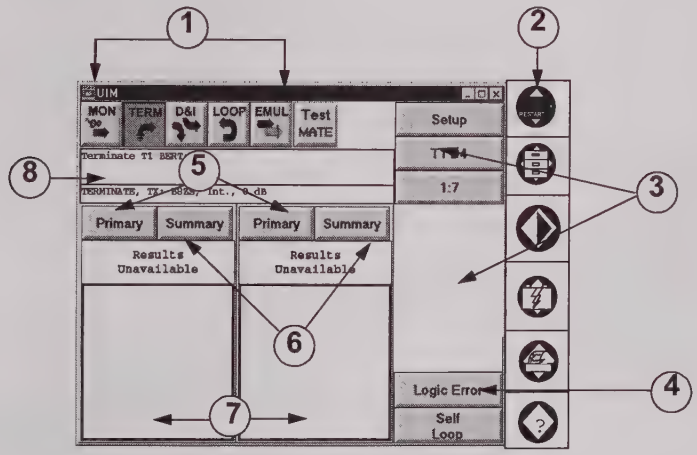


Figure 2-1. Main Screen

The Main Screen is divided into eight areas, as shown in Figure 2-1. Each area has a function, as described in the following paragraphs.

1. **Application Icon Selection**— This area displays **MON** (Monitor), **TERM** (Terminate), **D&I** (Drop and Insert), **LOOP** (Loopback), **EMUL** (Emulate), and **TestMATE** (if the TestMATE Option is installed) icons used to select a test group and specific test applications within that group. Refer to Figure 2-2 to view selections (represented by their respective pull-down menus) of those application icons for test setups.

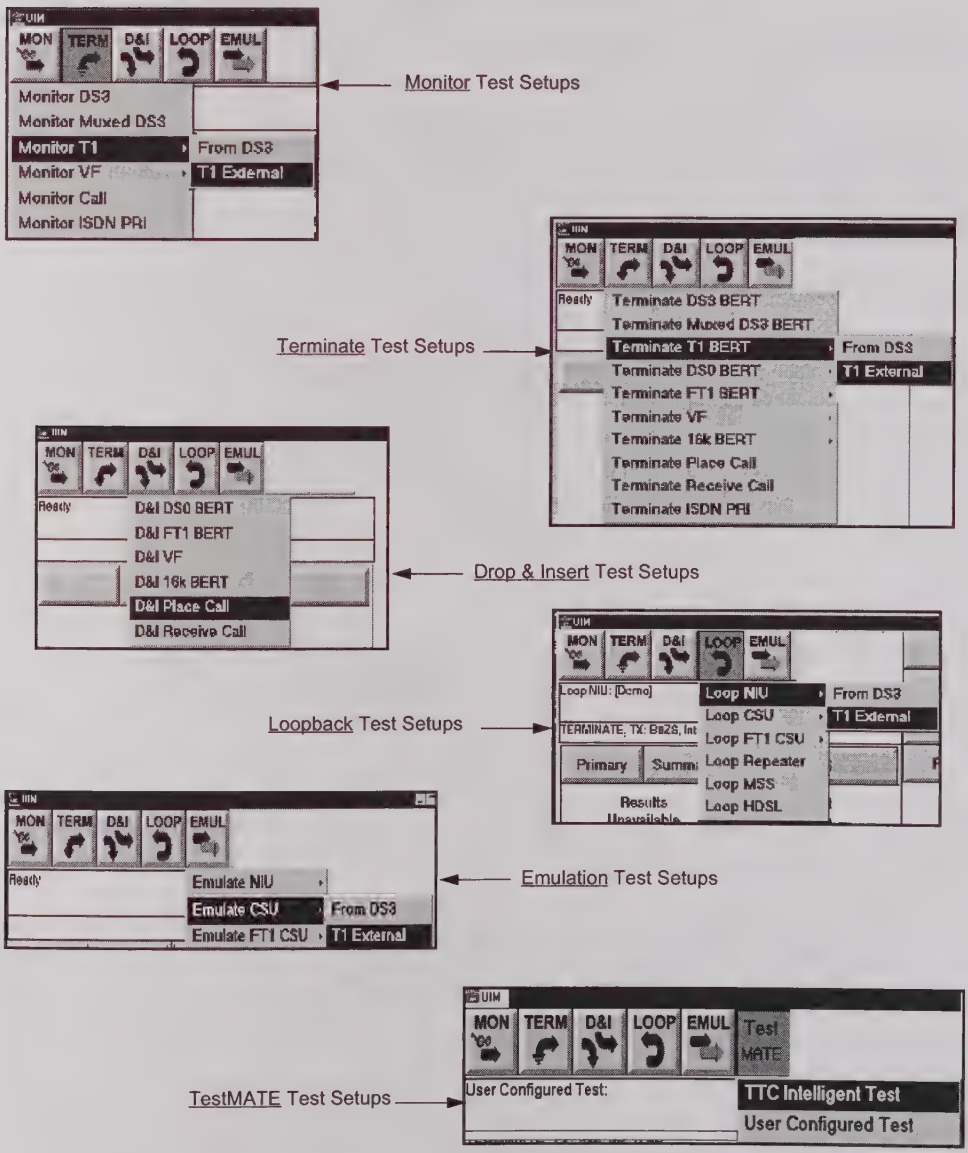


Figure 2-2. Application Icons with Pull-Down Lists

2. **Permanent Softkeys** — This area includes six permanent softkeys that provide housekeeping functions for the 2209 module. These keys perform the functions described in Table 2-1.

Table 2-1. Permanent Softkey Icons

Icon	Description
	RESTART — Performs the test restart function, including resetting the current test result totals and clearing any error alarms.
	AUX Functions — Activates the Auxiliary Functions screen, which allows you to view the software revision level and installed options, as well as set the speaker volume, time and date, and brightness control. Accesses VT100 Emulation Option as well.
	Screen Contrast — Adjusts the level of detail on the screen display. Pressing the left side lightens the images, and pressing on the right side darkens the images.
	Battery Status — Activates the Battery Status Screen, which displays the current battery strength by bar graph and percentage value.
	Printer Setup — Activates the Printer Setup Screen, which enables selection of the printer interface parameters (baud rate and parity), and allows you to clear the print buffer, print results, or abort printout.
	Help (?) — Provides on-screen phone number for Acterna Technical Assistance Center (TAC).

3. **Quick Configuration Softkeys** — These multiple configuration buttons appear based upon the type of test initiated. The **Setup** button allows you to change configurations. Figure 2-3 depicts real-test usage. Refer to Section 2.2 for information on how these buttons apply to the Property Sheets.

4. **ACTION Softkeys** — These action buttons are designed to take specific action during a test to initiate and measure the test (see Figure 2-1 and Figure 2-3).

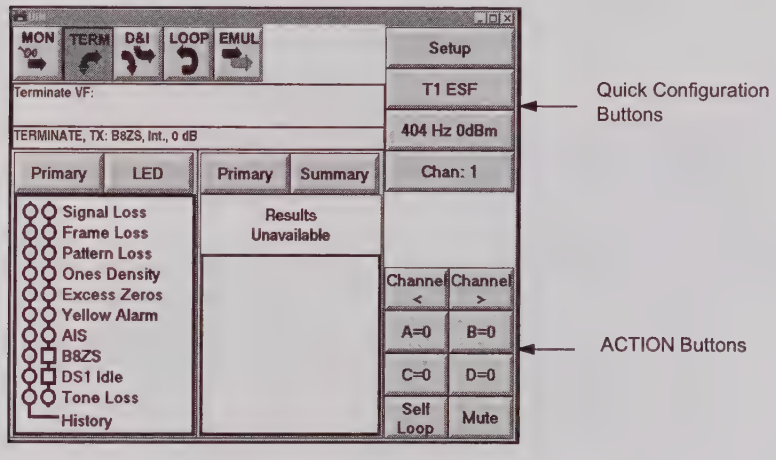


Figure 2-3. Sample Configuration/ACTION Button Usage

5. **Results GROUP Display** — The first button in this dual-results display depicts a drop-down list of the current test results, and lets you choose the *source* of results. Select Primary or Secondary receivers by choosing **Primary** or **Secondary** (see Figure 2-1 and Figure 2-4).

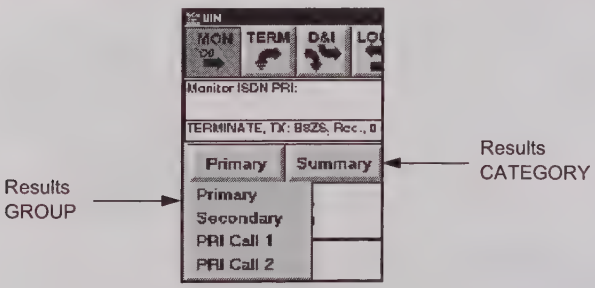


Figure 2-4. Results GROUP/CATEGORY Selection on Main Menu Screen

6. **Results CATEGORY Display** — The second button in this dual-feature display offers a drop-down list allowing you to choose test results in numerous *categories*. Results appear based on the application and test selections (see Figure 2-1 and Figure 2-4).

7. **Dual Test Results Display** — This area (see Figure 2-1) displays two test results windows associated with the current test application. Each window has a button for selecting the Result GROUP, a button for selecting the Result CATEGORY, a Result VALUE display window, and a Result LIST box. Figure 2-5 shows a sample Dual Test Results Display.

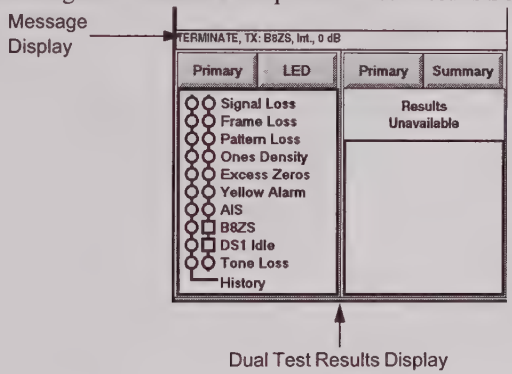


Figure 2-5. Dual Test Results Display

8. **Message Display** — This area (see Figure 2-1 and Figure 2-5) displays messages regarding activity associated with the current test application. The message display is comprised of:

   - **Test State/Status**: Shows the current test application. It also indicates the progression of a test, such as the transmission of loop codes and whether or not that operation was successful.
   - **Setup:** Shows a summary of the test configuration setup.

2.1.1 Results Category Descriptions

Figure 2-6 shows the type of results possible in the 2209, defined as follows:

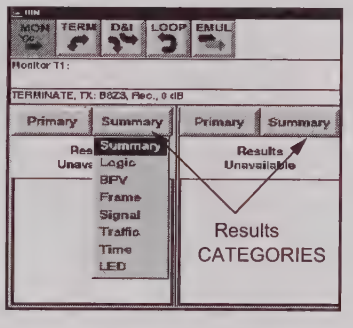


Figure 2-6. Pull-Down List in Results CATEGORY

Summary — This is the default category that automatically displays critical non-zero or out-of-specification results.

Logic — Logic errors are based on discrepancies between the transmitted and received bit stream. The accumulation of logic errors is dependent on frame synchronization (if in a framed mode) and pattern synchronization. When in ESF framing, the logic error inserts a CRC error. Logic errors are not available until initial pattern synchronization is obtained. During loss of frame or pattern synchronization, the accumulation of errors halts. Refer to Table 2-2 for logic results definitions.

.

Table 2-2. Logic Results

Result	Description
Pattern Losses	Loss of valid T1 pulses, where XX is a running count of pattern losses since last restart.
Bit Errors	Number of received bits that have a value opposite that of the corresponding transmitted bits after pattern synchronization.
Bit Error Rate	Ratio of bit errors to receive pattern data bits.
Patt Loss Sec	Number of seconds during which pattern sync was not maintained for the entire second.

Table 2-2. Logic Results (Continued)

Result	Description
Error Sec	Number of test seconds where one or more bit errors occurred.
Error Free Sec	Number of seconds where pattern sync was maintained through entire second and no bit error occurred.
%Error Free Sec	The ratio, expressed as a percentage, of error-free seconds to total number of seconds during which pattern sync is present.

BPV — Bipolar Violations are caused by successive pulses with the same polarity being detected (except those pulses that are part of the B8ZS encoding). Bipolar violation results are accumulated when the signal is present. Refer to Table 2-3 for BPV result definitions.

Table 2-3. BPV Results

Result	Description
BPV Errors	Bipolar Violations; a count of BPVs since the start of elapsed time (excluding intentional violations found within B8ZS codes).
BPV Erred Secs	Count of seconds wherein one or more BPVs occurred since the last test restart.
BPV Rate	Ratio of BPVs to total bits received.

Frame — Frame errors are based on counting framing bits and identifying frame errors in the incoming signal after initial frame synchronization. The results are available whenever the receiver detects a valid framed signal, regardless of the transmitter framing mode. Refer to Table 2-4 for frame result definitions.

Table 2-4. Frame Results

Result	Description
	Number of discrete losses of frame synchronization since initialization.

Table 2-4. Frame Results (Continued)

Result	Description
Frame Errors	Number of frame errors detected since initial frame synchronization or last test restart. For D1D and D4 (Superframe), frame errors are counted if either an F_t or F_s frame bit is errored. For SLC-96 framing, frame errors are counted if F_t bits are errored. For ESF (Extended Super Frame) framing, frame errors are counted only if an error is found on the FPS (Fast Packet Switching) bits. Frame errors are not detected on the CRC or datalink bits.
Frame Erred Secs	Number of seconds wherein one or more frame errors occurred since the last test restart.
Frame Error Rate	Ratio of frame errors to the number of analyzed framing bits.
Frame Loss Secs	Number of seconds wherein frame sync was lost or not achieved since initial frame sync or last test restart. Includes seconds where signal loss causes frame sync loss.
Frame SES	Number of seconds during which 12 or more frame errors occurred (D4 framing only).
CRC Errors	Number of CRC (Cyclic Redundancy Check) errors detected since initial frame sync or last restart. (Detected in ESF framing.)
CRC Erred Secs	Number of seconds wherein one or more CRC errors occurred since last test restart.
CRC Error Rate	Ratio of CRC errors to number of ESF frames received.
CRC SES	CRC Severely Errored Seconds; number of seconds during which the total number of CRC errors and frame synchronization losses equaled 320 or more.

Signal — The Signal category results include signal losses, frequency, level, and simplex current measurements. Refer to Table 2-5 for signal result definitions.

Table 2-5. Signal Results

Result	Description
Rx Frequency	Frequency of the clock recovered from received data.
Simplex Curr mA	Magnitude of simplex current flowing between Tx output tip-and-ring and Rx input tip-and-ring expressed in milliamperes. Simplex current displays as a number from 10 to 180. If current is less than 10mA, then "<10" displays; if current exceeds 180 mA, then ">180" displays.
Level dBdsx	Level of received dB signal, relative to standard 3-volt base-to-peak signal (DSX level).
Level dBm	Power level of an unframed, all-ones signal (available only when AIS is detected).
Level Vpp	Level of received signal in peak-to-peak volts. Signal level displays as volts (V) when signal level > 1 volt, or as millivolts (mV) when signal level < 1 volt.
Timing Slips	Number of bit slips counted when primary RX jack input slips from the secondary RX jack input, used as a reference. Timing slips display as the number of bit slips, either positive or negative, dependent on whether reference clock signal is lower or higher in frequency. A framing slip equals 193 bit slips.
Frame Slips	Number of frame slips based on frequency deviations (uncontrolled clock slips) between two input signals measured in positive or negative shifts in bits slips.
Slip Analysis Secs	Count of test seconds during which Timing Slip Analysis occurred.
Signal Losses	Count of valid T1 pulse losses, due to cable removed or cessation of signal over circuit.
Signal Loss Secs	Count of seconds where signal sync was lost or not achieved since last restart.

Traffic — The Traffic category displays results for all 24 DS0 timeslot or channel signaling bits, data bits, and channel assignments. Refer to Table 2-6 for traffic result definitions.

Table 2-6. Traffic Results

Result	Description
Traffic CH #	A display of signaling bits for each channel (C & D for ESF framing only).

Time — The Time category shows the elapsed time since the test started, as well as the date and time. Refer to Table 2-7 for Time result definitions.

Table 2-7. Time Results

Result	Description
Elapsed Time	Time in HH:MM:SS format since last test restart after a signal has been detected. Time continues to increment during signal losses.
Date	Current Date
Time	Current Time

LED — Selection of this category activates the Signal Alarm LEDs display. Two columns of LEDs reflect the current and history condition for each alarm. When an alarm first occurs, the appropriate current LED illuminates and remains illuminated until the condition clears. If the condition clears, the History LED for that alarm illuminates and the current LED extinguishes. If the condition occurs again, the current LED illuminates and the History LED remains illuminated to show the condition also occurred in the past.

2.1.2 Additional Test Results

Additional test results are listed with the application and test setup procedures in each of the option sections. For detailed explanations of the test results listed below, refer to the appropriate section.

Signal-to-Noise Ratio Results — See Section 3.6.

PRI ISDN Results — See Section 4.10.

2.2 APPLICATION SETUP PROPERTY SHEETS

When any of the quick configuration buttons are pressed, Setup Property Sheets (which are tabulated for subsequent choices) appear on the LCD. These setup sheets consist of a setup **Summary** (Figure 2-7) and property sheets (Figure 2-8) that provide the parameters for all test settings not determined by the default test setup.

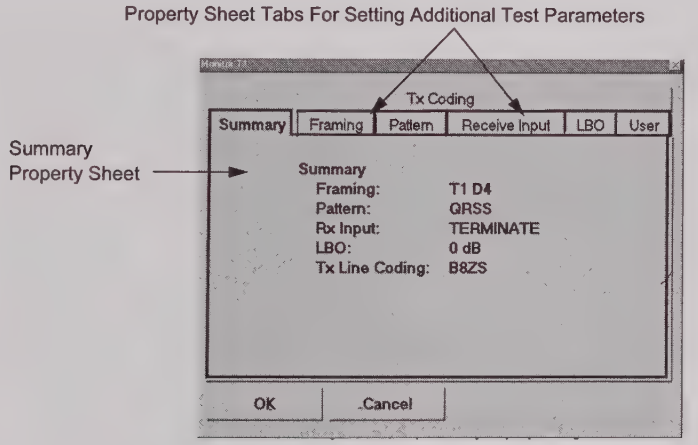


Figure 2-7. Setup Summary Property Sheet

When pressed and applicable, the **Setup** configuration key prompts a **Summary** Sheet that allows you to double check that you are configuring the test set for the analysis parameters you want. Behind the **Summary** Property Sheet, you see tabs of additional setup sheets that prompt you to change parameters for the test application for specific tests.

Alternatively, pressing any of the quick configuration buttons will activate the 2209 to bring up the property sheets. Pressing any of the tabs immediately brings up the desired screen to set your parameters. Figure 2-8 shows a random sampling of property tabs within the property sheets.

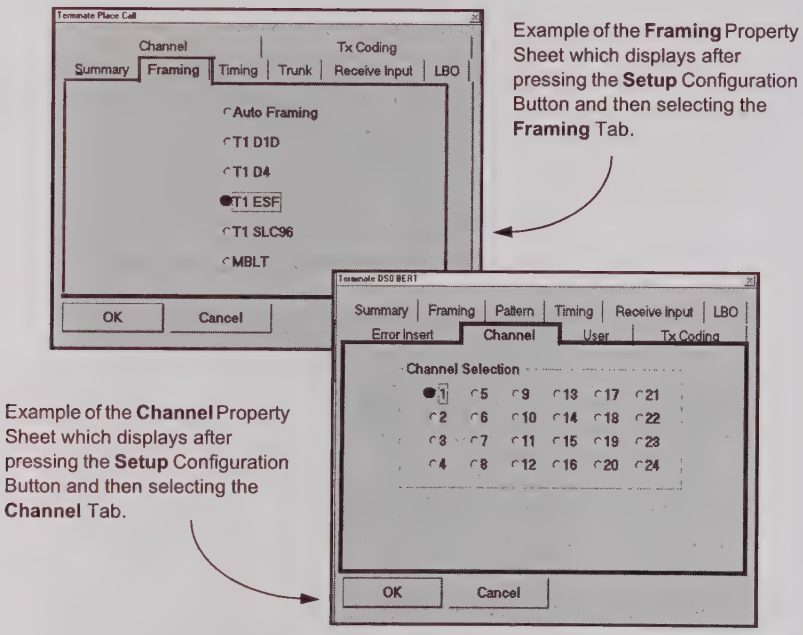


Figure 2-8. Property Sheet Tabs Set Test Parameters

Remember to press **OK** on the property sheet to set the value. You can also cancel the settings by pressing **CANCEL**.

2.3 USING THE 2209 MODULE

To operate the 2209, you only need to turn on the test set, wait for the main screen to appear, then perform the following steps:

NOTE

We recommend using the stylus supplied with the 2209 to activate functions on the touch-sensitive screen. However, any blunt device, including your finger, can be used.

1. Select an Application Icon, the FIRST STEP of any test.

2. Select an application from the list of application choices in the pull-down menu that appears when the icon is selected. The 2209 configures a default setting for the selected test. Figure 2-9 shows an example of choosing a Monitor T1 setup application.

3. The buttons in the configuration section show the current settings. To change a setting, press the appropriate button.

NOTE

As an alternative, you can use the quick configuration buttons (below ***Setup****) to change settings. These buttons also display current setting.*

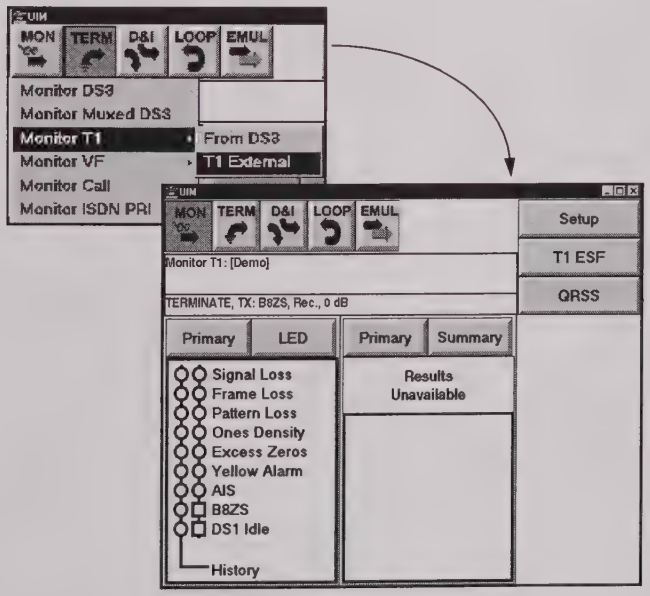


Figure 2-9. Choosing an Application

4. To check or change the configuration, press **Setup**, which replaces the main screen with the setup screen (Figure 2-10). The setup screen starts with the **Summary** tab with property tabs set behind it for each of the parameters you may want to change from the default test setting.

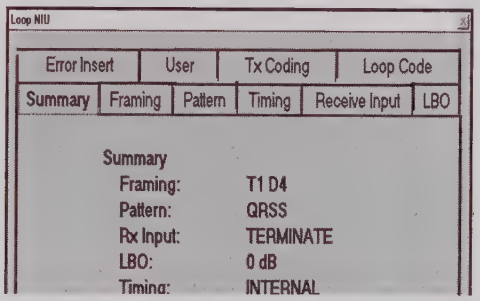


Figure 2-10. Property Tabs Behind Summary Sheet

5. To change a parameter, press the appropriate property sheet tab to move it to the front. Set the desired parameters accordingly.

6. When done, press **OK** on the bottom of the screen to accept the new values and return to the main screen. The buttons reflect the new setup or press **Cancel** to leave the values as they were and return to the main screen.

7. Key parameters appear as buttons immediately below the **Setup** button. Typically **Framing** and **Pattern** buttons appear here. For Loop applications, a **Loop Code** button appears with the current loop code (e.g., FAC2 for NIU Loopback). You can touch any of these buttons to go to the setup screen with that folder in front, ready for changes.

8. Once all parameters are correct, connect the 2209 to the circuit using the Primary and/or Secondary TX and RX jacks. For instrument safety, we recommend connecting the cables to the RX or TX jack first, then the T1 circuit. Test results automatically begin accumulating.

9. For loopbacks and some other applications, some secondary ACTION buttons appear in the quick configuration area. Touch the appropriate button to perform the labeled function (e.g., **Loop Up** to send the loop up code or **Loop Down** to send the loop down code).

10. To clear alarms and begin the test, press the **RESTART** Permanent Softkey.

11. Observe the test results in the Dual Test Results Display. All available results are listed in the Test Results List, while the currently selected result is shown in the Test Result display above the list. Touch a specific test result in the Test Results List to see it in the Test Result display.

2.4 BATTERY OPERATION

The 2209 comes equipped with a rechargeable Nickel-Metal Hydride (NiMH) battery. A fully-charged battery is good for 3 hours of continuous use. If the DS3 option is installed and in use, a fully-charged battery is good for 2 hours of continuous use.

Before using your 2209, you first need to install the battery. Fully charge the battery before first use, and check its status by reading the gauge.

2.4.1 Battery Installation and Replacement

The Nickel-Metal Hydride (NiMH) battery is easy to install and replace.

1. Turn off the 2209.
2. Open the Battery Access Door at the bottom of the 2209 by sliding the latch back from the edge of the test set and pulling the Battery Access Door open on its hinge.
3. Line up the battery with the terminals facing up and pointing toward the battery compartment (You should be able to read the terminal markings (-) T D C (+) at the top end of the battery.)
4. Gently slide the battery into the battery compartment until the terminals click into place. The bottom of the battery should be about a quarter of an inch inside the compartment.
5. Close the Battery Access Door and slide the latch toward the edge of the unit to secure the Battery Access Door in place.
6. Turn on the 2209 and continue testing.

NOTE

The 2209 battery is "hot-swappable" such that if AC power is connected, you can swap/replace the battery without affecting current test.

2.4.2 Battery Charging

The Battery Low LED illuminates when the battery is at 25% of full charge to indicate the battery needs to be recharged. The battery can be recharged while the 2209 is being used for testing by connecting the AC Adaptor from the 18 VDC plug on the bottom of the test instrument to a 120 VAC power supply. This allows you to continue testing, but it lengthens the recharge time.

****
*** CAUTION ***
****

Do not allow the battery to discharge completely! It is extremely important for optimal battery performance to always keep the battery charged, or to remove the battery from the unit when not in use.

To fully charge the battery quickly, turn the unit off, connect the AC Adaptor from the 18 VDC plug to a 120 VAC power supply and let the 2209 sit for about 1 1/2 to 2 hours depending on how low the battery was.

SECTION 3 COMMON APPLICATIONS

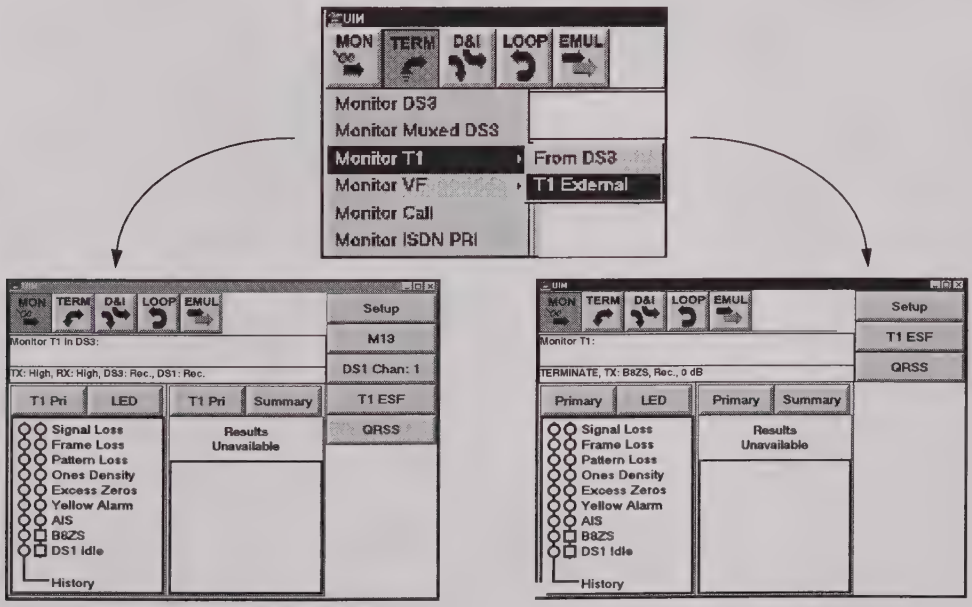
The following setup procedures are the most commonly used for the 2209 to test T1 and DS3 circuits. *As in any test, always configure the unit before connecting to the circuit.*

3.1 MONITORING T1 PERFORMANCE

This test allows you to:

- Non-intrusively monitor the T1 facility.
- Confirm that the T1 signal is properly received by the network equipment.

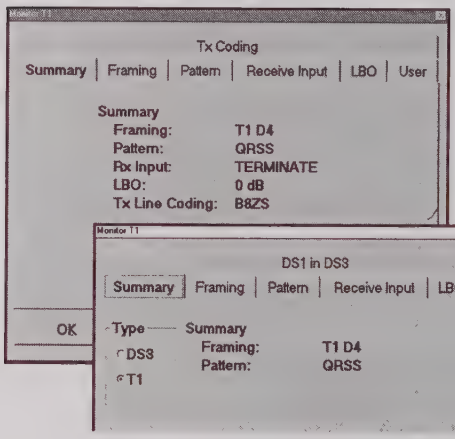
1. Press **Mon**. Then, select **Monitor T1** from the pull-down menu, followed by either **From DS3** or **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



Default Setup for Monitor T1 from a DS3 (to DS1) Connection

Default Setup for Monitor T1 from a T1 External Connection

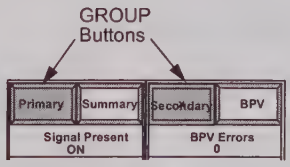
2. Press **Setup**. Ensure the characteristics shown in the setup **Summary** screen match the network characteristics (such as T1D4). To change settings, select the desired property sheet tabs in the property setup sheets.



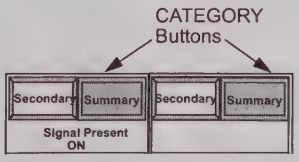
Summary Sheet for Monitor T1 from T1 External

Summary Sheet for Monitor T1 from DS1 in DS3

3. Exit the configuration setup screen by pressing **OK**.
4. Set Result GROUP buttons to **Primary** (left) and **Secondary** (right).



5. Set Result CATEGORY buttons to **Summary**.



6. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DSX-1 test access points.

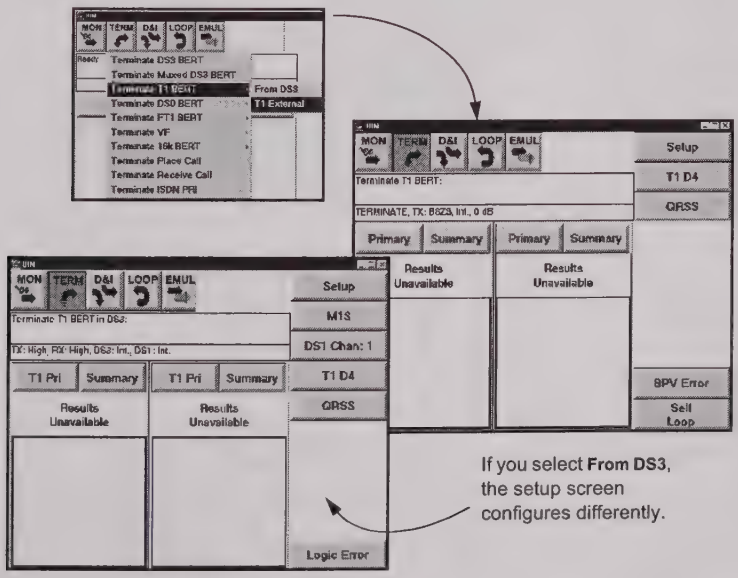
7. Press the **RESTART** permanent softkey to clear alarms and begin the test.

8. Verify the SIGNAL and FRAME LEDs are illuminated and the Primary and Secondary Results displays show `RESULTS OK`.

3.2 T1 LOOPBACK BER TEST

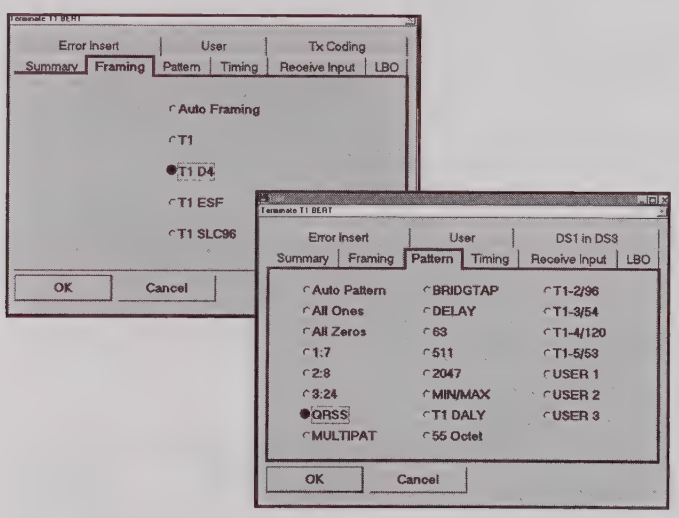
This test allows you to qualify T1 circuit error performance by testing for logic errors, BVPs, frame errors, and CRC errors (if applicable) on T1 lines.

1. Select **TERM**. Then, select **Terminate T1 BERT**, followed by **T1 External** or **From DS3** from the pull-down menu. (**Terminate DS0 BERT** and **Terminate FT1 BERT** are also T1 Termination Setups.) The unit automatically configures to a default setup screen. Access point choices are given with DS3 option.



This test assumes the testing is done from a DSX-1 patch panel where a loopback already exists at the far end.

2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics. To change settings, select the desired tabs in the property setup sheets. *Make sure you select the* ***Receive Input*** *Tab and select* ***TERM*** *for each receiver for this test.*
3. Select proper **Framing** (T1, T1D4, T1 ESF, or T1 SLC96).
4. Select appropriate **Pattern**.



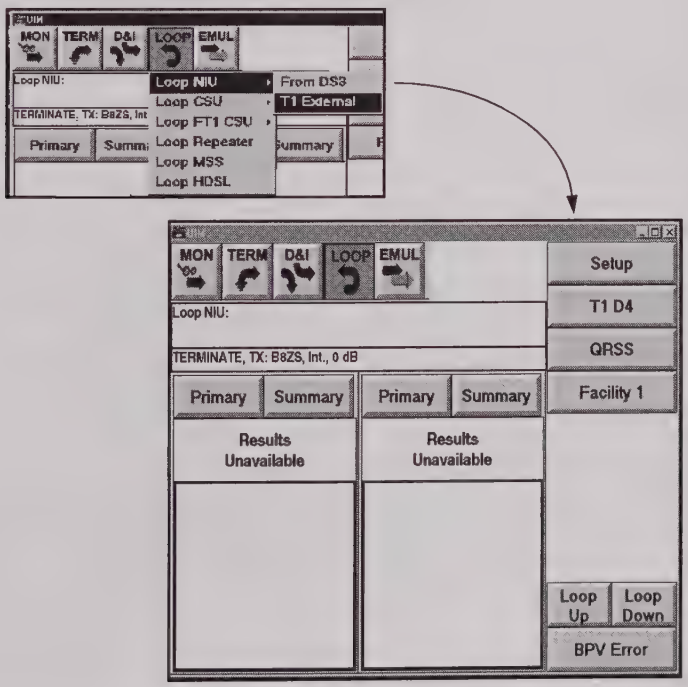
5. Set **Tx Coding** as appropriate (B8ZS or AMI).
6. Set **Timing** to INTERNAL if emulating central office equipment. Set Timing to RECOVERED (loop) if emulating customer premises equipment.
7. Set **LBO** to appropriate value (typically 0 dB).
8. Set **Receiver Input** to TERMINATE.
9. Set **Error Insert** to DS1 LOGIC.
10. Press **OK**.
11. Connect a cable from the PRIMARY TX jack to the appropriate DSX-1 IN jack.
12. Connect a cable from the PRIMARY RX jack to the appropriate DSX-1 OUT jack.
13. Press the **RESTART** permanent softkey to clear alarms and begin the test.

Verify the Primary SIGNAL, FRAME, and PATTERN LEDs are illuminated and the Primary Results display shows RESULTS OK.

14. Insert one or two errors by pressing the **Logic Error** ACTION button to verify connectivity.

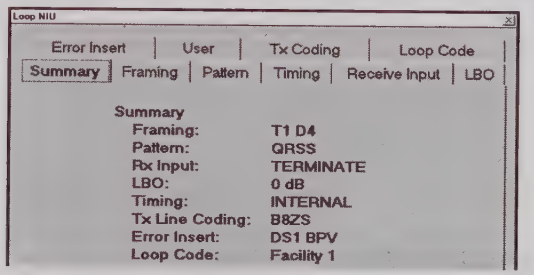
3.3 T1 LOOPBACK TEST FROM A DSX-1

1. Select **LOOP**. Then, select **Loop NIU** from the pull-down menu, followed by **T1 External** (if DS3 Option is installed).

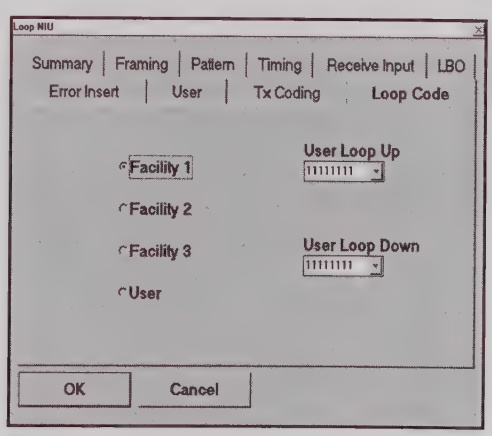


2. Press **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics.

3. To change baseline settings, select the desired tabs in the property setup sheets.

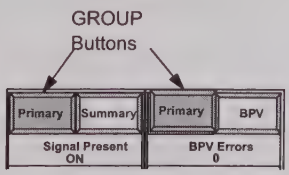


4. A **Loop Code** tab appears in the tab selections (as well as in the quick configuration area) with the current loop code (e.g., FAC2). If required, select the loop code type.

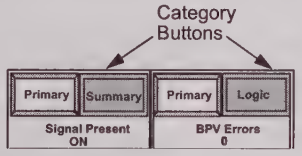


5. Press **OK**.

6. Set the Result GROUP buttons to **Primary**.

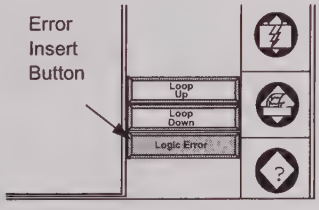


Set the left CATEGORY button to **Summary** and set the right CATEGORY button to **Logic**.



7. Press the **Loop Up** ACTION button to send the loop code. If loop up is successful, the message `LOOP UP SUCCESSSFUL` flashes.

8. Press the **Logic Error Insert** ACTION button to transmit bit errors to verify the loopback. Observe bit errors in the Primary Results display.



9. Press the **RESTART** permanent softkey to clear alarms.

   Verify the Primary SIGNAL, FRAME, and PATTERN LEDs are illuminated and the Primary Results display shows `RESULTS OK`.

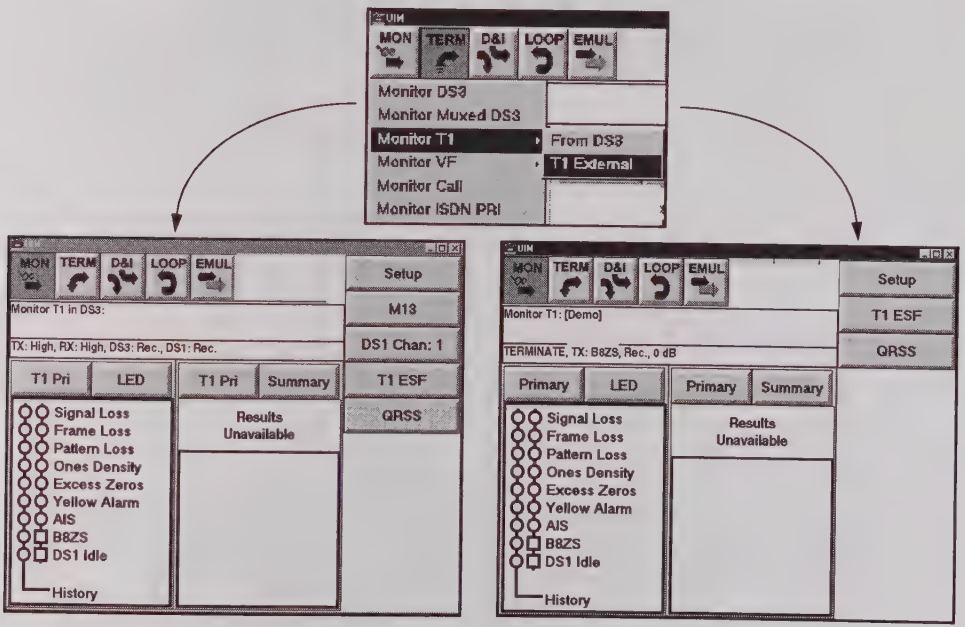
10. Perform the desired tests on the looped back circuit.

11. When testing is completed, press **Loop Down** to loop down the looped equipment. **Loop Down** remains depressed until the loop down is accomplished. If loop down is successful, the message `LOOP DOWN SUCCESSFUL` flashes and the Pattern LED goes out.

3.4 MONITORING A/B/C/D SIGNALING BITS

This application allows you to view the signaling bits for all of the 24 channels for both the Primary and Secondary lines, simultaneously.

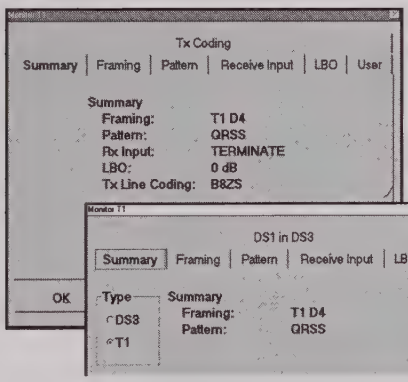
1. Press **Mon**. Then, select **Monitor T1** from the pull-down menu, followed by **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



Default Setup for Monitor T1 if you select **From DS3**.

Default Setup for **Monitor T1** from a T1 external connection.

2. Press **Setup**. Ensure the characteristics shown in the setup **Summary** screen match the network characteristics (such as T1D4). To change settings, select the desired property sheet tabs in the property setup sheets.

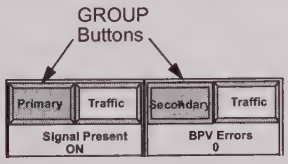


Summary Sheet for **Monitor T1** from T1 External.

Summary Sheet for **Monitor T1** from DS1 in DS3.

3. Exit configuration setup screen by pressing **OK**.

4. Set Result GROUP buttons to **Primary** (left) and **Secondary** (right).



5. Set Result CATEGORY buttons to **Traffic**.

6. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).

7. Press the **RESTART** permanent softkey to clear alarms and begin the test.

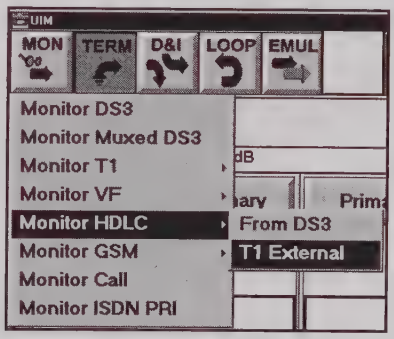
8. Verify the SIGNAL and FRAME LEDs are illuminated. Observe all 24 channels for Primary and Secondary in two groups of 12 channels each.

3.5 MONITORING FRACTIONAL HDLC STATISTICS

High-Level Data Link Control (HDLC) is a standard bit-oriented protocol wherein control information is always placed in the same position. In HDLC, specific bit patterns used for control differ dramatically from those used in representing data, so that errors are less likely to occur. Many bit-oriented protocols like SS7 and frame relay use HDLC as the datalink layer protocol. Many wireless systems use "packet pipe" systems utilizing several contiguous DS0s in a frame relay-like manner to

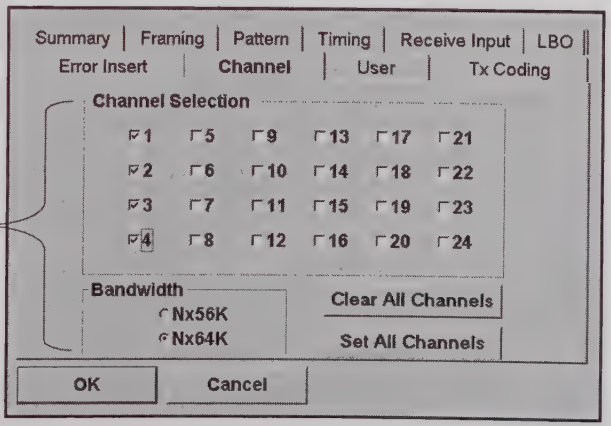
carry data from the base station to the switch. Fractional HDLC allows you to analyze a fractional T1 circuit for HDLC frames. This option enables you to analyze standard HDLC statistics. The HDLC Option is required.

1. Press **Mon.** Select **Monitor HDLC** from the pull-down menu, followed by **T1 External** (or **From DS3** if the DS3 Option is installed). The unit automatically configures to a default setup screen.



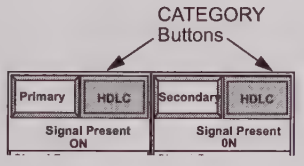
2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics. Select the **Channel** property sheet and check the *group* of channels you want to monitor.

Fractional HDLC enables grouping of channels to monitor within a T1 network. Select the channels to be tested. Also select the bandwidth and clear or set channels as needed.



To change other settings, select the desired property tabs in the property setup sheets.

3. Press **OK**. Set Result GROUP to **Primary** and **Secondary**.



4. Set each Result CATEGORY to **HDLC**.
5. Connect one cable from the PRIMARY RX jack to the DS1 test access point (DSX-1 patch panel).
6. Press the **RESTART** permanent softkey to clear alarms and begin the test.

7. Verify the SIGNAL and FRAME LEDs are illuminated (green).
8. Observe results. Table 3-1 shows six possible results available for HDLC.

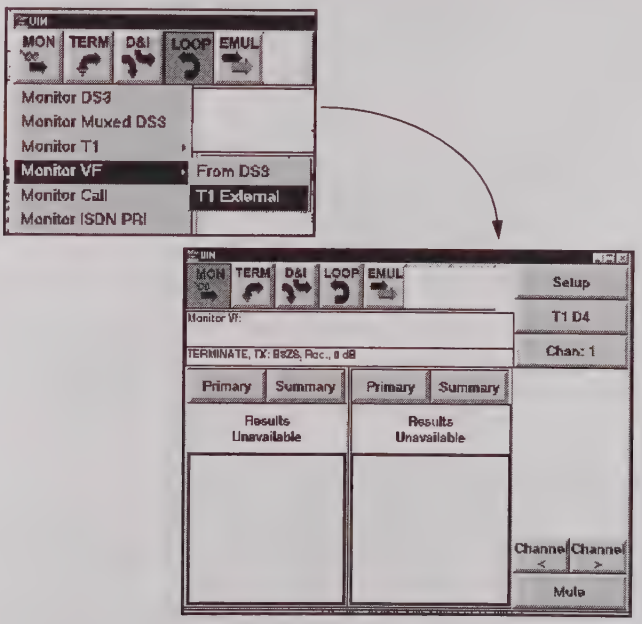
Table 3-1. Fractional HDLC Results and Range

Result	Definition
Frame Count	HDLC frames with valid CRCs.
CRC Erred Frames	HDLC frames with CRC-16 errors
Aborted Frames	Number of aborted HDLC frames. An aborted frame is one containing 7 consecutive ones.
Non-Octet Frames	Number of HDLC frames not containing a whole number of bytes.
Discarded Frames	Total number of frames discarded due to overflow.
% Link Utilization	The percentage of available bandwidth being used to carry packet data.

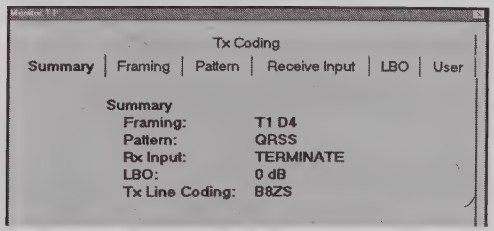
3.6 MONITORING VF

The following procedure outlines how to use the 2209 to monitor DS0 (VF) channels out of a DS1 signal. The VF PCM TIM Option is required.

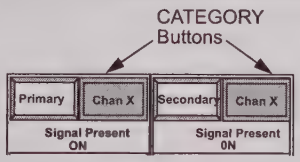
1. Press **Mon.** Select **Monitor VF** from the pull-down menu, followed by **T1 External** (or **From DS3** if the DS3 Option is installed). The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics (such as AMI), as well as the desired VF channel. To change the settings, select the desired property tabs in the property setup sheets.



3. Press **OK**. Set Result GROUPS to **Primary** and **Secondary**.



4. Set Result CATEGORYS to **Chan X** where "X" is the VF channel selected.
5. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).
6. Press the **RESTART** permanent softkey to clear alarms and begin the test.

7. Verify the SIGNAL and FRAME LEDs are illuminated (green).
8. Observe results. Use the Channel (< >) buttons to select other channels to monitor.

3.6.1 Signal-To-Noise Ratio Measurements

Signal-to-Noise Ratio (SNR) is the ratio of the amplitude of the desired signal to the amplitude of noise signals at a given point in time, usually expressed in decibels. Its application within the 2209 enables analysis wherein received voice frequency signals assume readable characteristics when specific tones are inserted into the transmission. Figure 3-1 shows the hook-up for the Signal-to-Noise Ratio test.

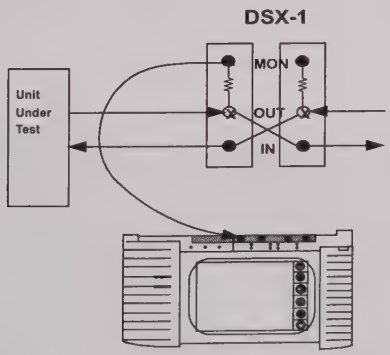


Figure 3-1. Monitoring VF Test Setup

Figure 3-2 shows the resulting Signal-to-Noise Ratio Results screen.

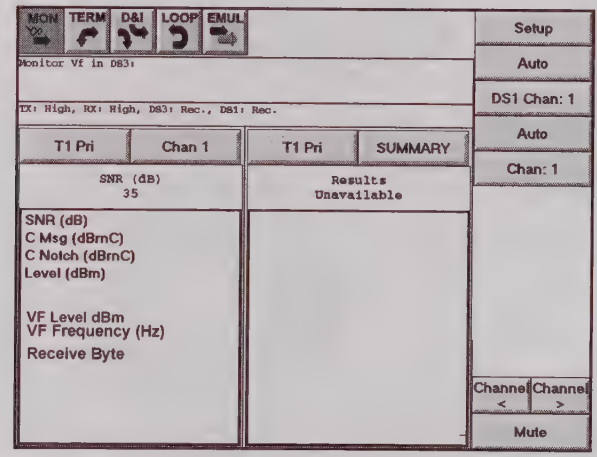


Figure 3-2. Typical Signal-to-Noise Ratio Results Screen

Refer to Table 3-2 for a description of these results.

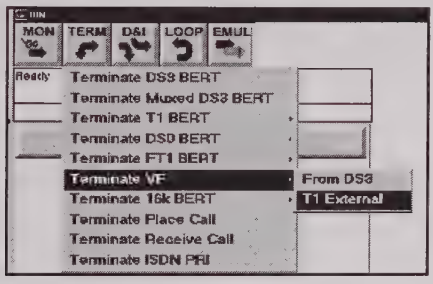
Table 3-2. Signal-To-Noise Ratio Results

Result	Description
SNR (dB)	Signal to noise ratio of the received signal assuming an 1004Hz tone inserted from an external source.
C Msg (dBrnc)	C-Message noise of the input signal. The noise is measured using a C filter.
C Notch (dBrnc)	C-Notch noise of the input signal. This assumes a 1004Hz tone inserted with an external source. The tone is first eliminated with a notch filter and a C filter is used to measure the noise
Level (dBm)	The measured power (in dBm) of the signal.
VF Frequency (Hz)	The frequency of the tone being received.
Receive Byte	The value of the current byte being received.

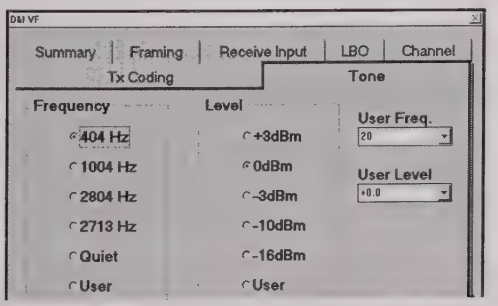
3.7 TRANSMITTING VF TONES FROM A DSX-1

The following procedure outlines how to use the 2209 to send test tones to help evaluate overall performance of a VF circuit from a T1 access point. The VF PCM TIM Option is required.

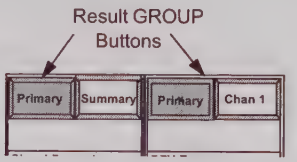
1. Press **TERM**. Then, select **Terminate VF** from the pull-down menu, followed by **T1 External** (if the DS3 Option is installed). The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure characteristics shown in the setup **Summary** screen match the network characteristics. To change settings, select the desired property sheet tabs in the property setup sheets.
3. Select the T1 (DS0) channel on which to transmit the signal.
4. Select the desired transmit frequency and level on the **Tone** property setup sheet. (Set to either user-specified or a pre-set tone level/frequency.) Press **OK**.



5. Press the AUX Functions permanent softkey. Set the volume to desired level, then exit the AUX Functions screen.
6. Set both Result GROUP buttons to **Primary**.



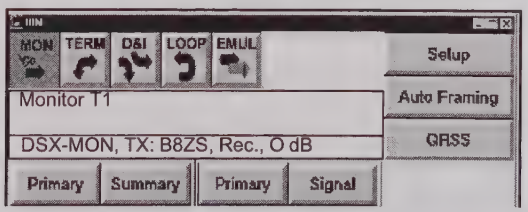
7. Set left Result CATEGORY to Summary and right Result CATEGORY to **Chan "xx"**, where "xx" is the VF channel selected.
8. Observe results.

3.8 IN-SERVICE DS1 TIMING SLIPS ANALYSIS

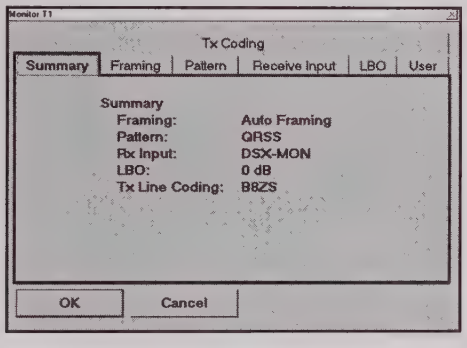
This application allows you to:

- Confirm that all the network equipment is properly synchronized.
- Verify network timing and isolate possible timing problems.

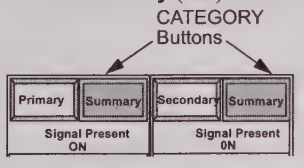
1. Press **Mon.** Select **Monitor T1** from the pull-down menu, followed by **T1 External** (or **From DS3** if the DS3 Option is installed). The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics (such as T1 ESF). To change the settings, select the desired property tabs in the property setup sheets.



3. Press **OK**. Set Result GROUPS to **Primary** (left) and **Secondary** (right).



4. Set the Result CATEGORY buttons to **Summary**.
5. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).
6. Press the **RESTART** permanent softkey to clear old test results and begin a new test. Verify the SIGNAL and FRAME LEDs are illuminated (green). If the signal is error free, RESULTS OK appears in both RESULTS displays.
7. Press the right CATEGORY button and select **Signal**.

8. Select **Timing Slips** and allow the test to run for at least 5 minutes. The result should be zero. If the result is not zero, the DS1 has two clock sources present on the circuit. *If you have timing slips, you will also have framing slips.* Figure 3-3 shows the hook-up for the DS1 Timing Slips Analysis.

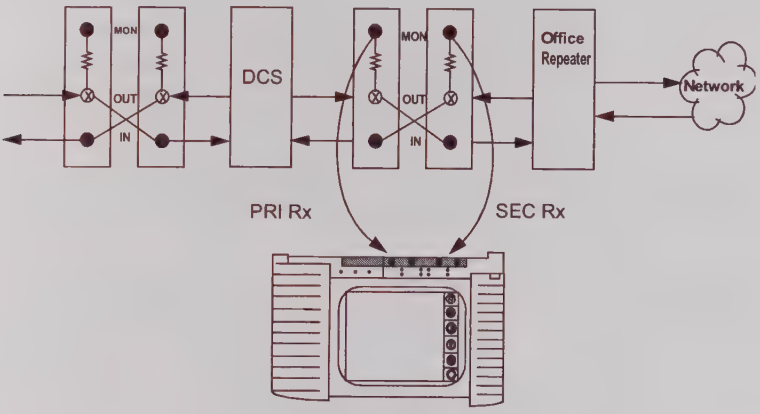
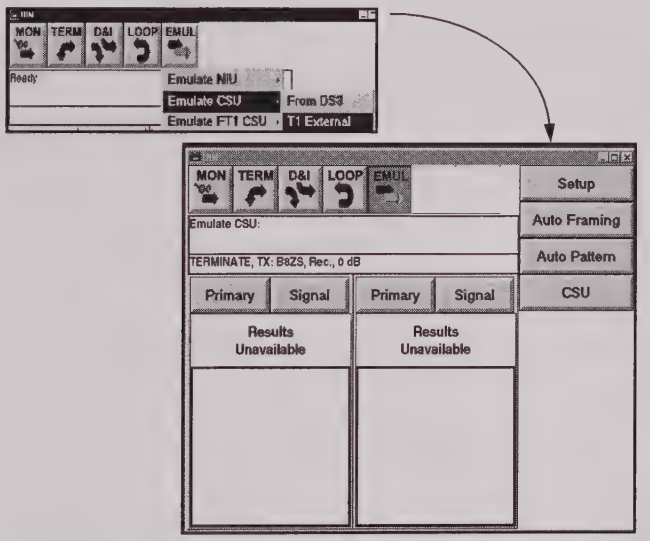


Figure 3-3. DS1 Timing Slips Analysis

3.9 CSU EMULATION

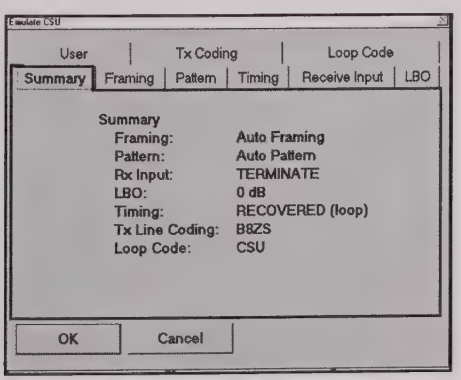
One CSU function is to complete the current path that powers the span repeaters. **HAZARDOUS VOLTAGES EXIST ON THE LINE SIDE OF THE CSU.** Local telephone company office alarms may sound when the current path is interrupted. Since telephone companies do not have a uniform policy regarding the disconnection of the CSU from the span, ***LOCAL TELEPHONE COMPANY INTERVENTION IS STRONGLY RECOMMENDED.*** Advanced notice should be given so that power can be removed from the span before disconnection of the CSU.

1. Press **EMUL**. Select **Emulate CSU** from the pull-down menu, followed by **T1 Externa**l (if the DS3 Option is installed. The unit automatically configures to a default setup screen.



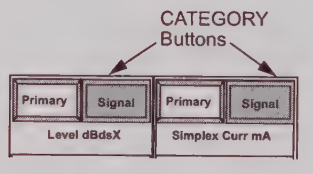
2. Press **Setup**. Ensure the characteristics shown in the **Summary** property setup screen match the network characteristics (such as TX Line Coding).

   To change the settings, select the desired property tabs in the property setup sheets.



3. Press **OK** to exit and save configurations:

4. Press **Primary** in the Results GROUPS window and select **Signal** in the Results CATEGORY window. Choose "Level dBdsx" for left Results window and "Simplex Curr mA" for right Results window.



5. Disconnect the Office Repeater power supply from the span being tested.

WARNING

High voltage may be encountered.

6. Once power has been removed, disconnect the CSU from the span line.
7. Connect cables from the 2209 PRIMARY TX and RX jacks to the NIU.
8. Restore power to the span line by connecting the office repeater power supply.
9. Check the Receive Level (Level dBdsx) and select the appropriate LBO (by going back into the configuration screen — press **Setup**) as follows:

If level is -15 dBdsx and below:	set LBO to 0 dB
If level is -14 to -8 dBdsx:	set LBO to -7.5 dB
If level is -7.5 dBdsx and above:	set LBO to -15 dB

10. Send the CSU loop-up code from the central office to the 2209. The 2209 responds by establishing an AUTO LLB mode (See Message Display beneath applications icons). This internally loops the receiver to the transmitter. Press the **RESTART** icon to restart the test.

11. Verify that loopback was successfully established and that the SIGNAL and FRAME LEDs illuminate. Make sure there are no errors — the ERROR LED should not be illuminated.

12. Select the **Summary** CATEGORY. If errors are not detected, RESULTS OK appears. If errors are detected, observe the **Summary** category results and check the individual error results as required.
13. To disconnect the loop, send the CSU loop-down code from the central office to the 2209. The 2209 responds by releasing the AUTO LLB mode.
14. Disconnect the 2209 from the span. Once done, disconnect the office repeater power supply from the span being tested.

WARNING

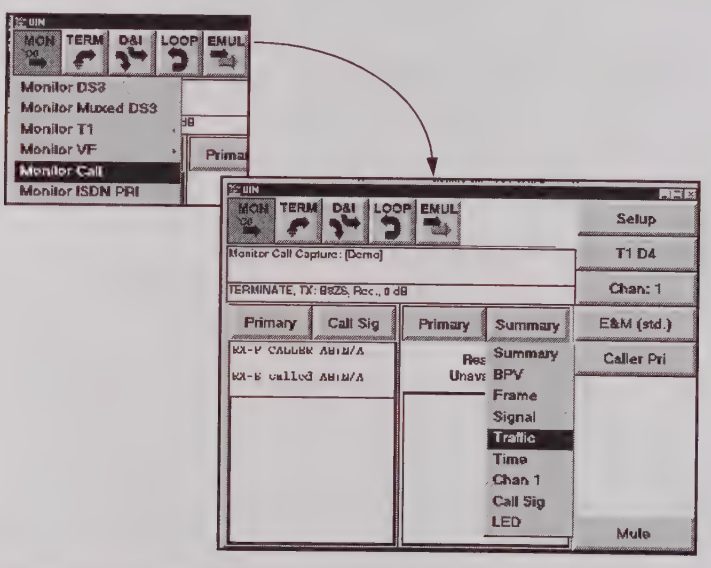
High Voltage may be encountered.

15. Reconnect the CSU and restore power to the span line.

3.10 SIGNALING MONITOR (CALL CAPTURE)

The following procedure outlines how to use the 2209 to perform Call Capture. The Signalling Option is required.

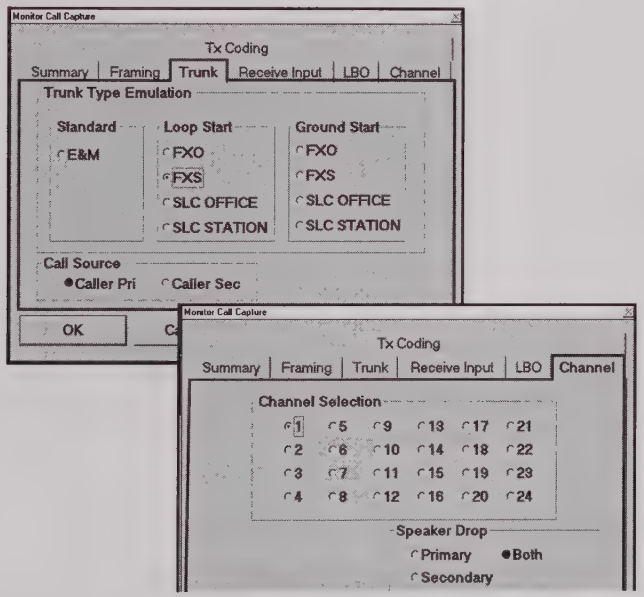
1. Press **MON.** Select **Monitor Call** from the pull-down menu. The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** property setup screen match the network characteristics. To change the settings, select the desired tabs in the property setup sheets.

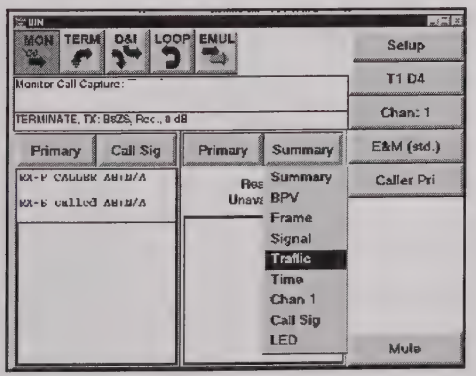
3. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or E&M) using the **Trunk** tab. Select the type of circuit equipment (e.g., SLC office, SLC station, FXO, or FXS) of the source of the call. Select the side from which the call is originating using the **Call Source** button.

4. Select the **Channel** tab and use the Speaker Drop to send primary, secondary or both channels to the speaker. Press **OK**.



5. Set the Result GROUP buttons to **Primary**.

6. Set Result CATEGORY buttons to **Call Sig** on the left and **Traffic** on the right.



7. Connect two cables, one from the PRIMARY RX jack, and the other from the SECONDARY RX jack to the DS1 test access point (DSX-1 patch panel).

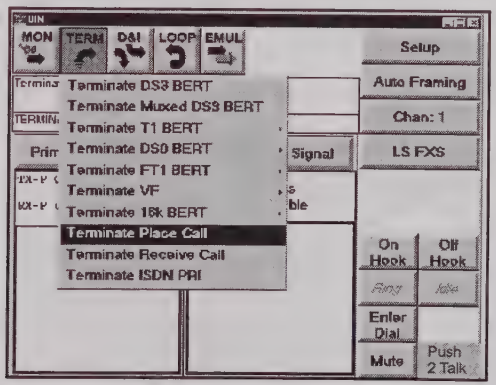
8. Press the **RESTART** permanent softkey to clear alarms and begin the test.

9. Verify the SIGNAL and FRAME LEDs are illuminated (green).
10. Observe the signaling activities in the results display.

3.11 PBX/SWITCH EMULATION (ORIGINATING A CALL)

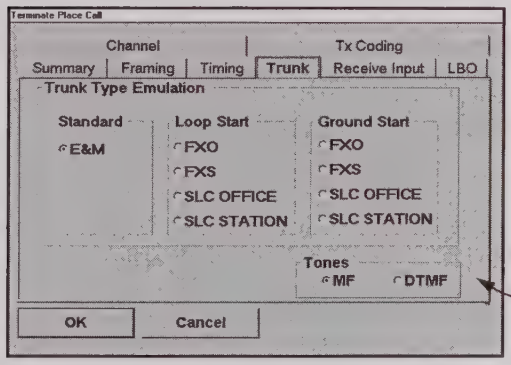
The following procedure outlines how to use the 2209 to perform Place Call. The Signalling Option is required.

1. Press **TERM**. Then, select **Terminate Place Call** from the pull-down menu. The unit automatically configures to a default setup screen.
2. Press **Setup**. Ensure characteristics shown in the setup **Summary** screen match the network characteristics. To change settings, select the desired property sheet tabs in the property setup sheets.

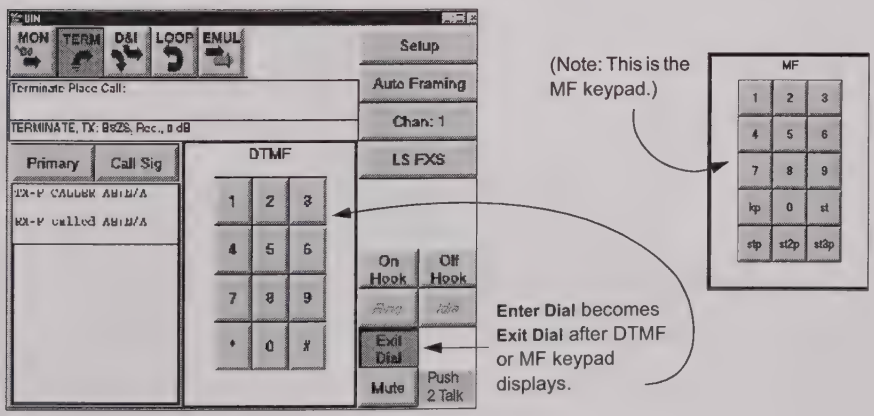


3. Select **Channel** tab in property sheet to choose the T1 channel (DS0) on which to transmit the signaling.

4. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or Standard E&M) using the **Trunk** tab. If Loop Start or Ground Start is selected, choose **FXS** or **SLC Station** (with SLC Framing) as the type of card emulation. Press **OK**.



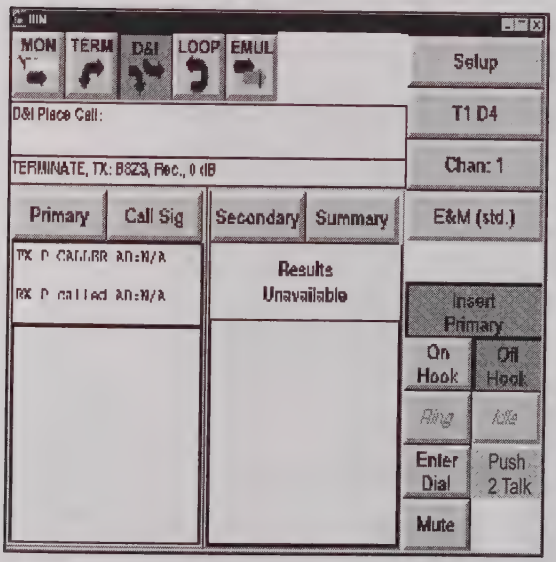
5. Connect a cable from the PRIMARY RX jack to the IN jack of the DSX-1. Connect a cable from the PRIMARY RX jack to the OUT jack of the DSX-1.
6. Press the **RESTART** permanent softkey to clear alarms. Verify the SIGNAL and FRAME LEDs are illuminated (green).
7. Press **Enter Dial** ACTION button to display the DTMF or MF keypad.



8. Select **Call Sig** Results CATEGORY display beside the Primary Results GROUP selection. Verify that **On Hook** is observed in the **Call Sig** Results CATEGORY.
9. Press the **Off Hook** ACTION button. Verify that **Off Hook** appears in the Results display, followed by either a **WINK** (on standard E&M trunks) or **Dial Tone** (on Loop and Ground Start trunks).
10. Dial test number on the numeric keypad.
11. Press **On Hook** to complete the call.
12. Select **Chan: X** Quick Configuration key to select another DS0 channel to test.

NOTE

*If in **D&I** mode, select the **Insert Primary** ACTION button to start inserting on the primary T1. Use the appropriate signaling buttons to place your call. Observe the signaling activity in the Call Signal window.*



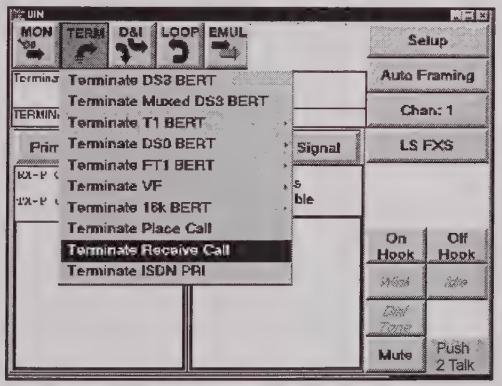
Press **Insert Primary** to start inserting on the Primary T1 network.

These Signaling ACTION buttons enable variences in testing. Use them for **On Hook**, **Off Hook**, **Ring**, **Idle**, access to the keypads (**Enter Dial**), and **Mute**.

3.12 PBX/SWITCH EMULATION (TERMINATING A CALL)

The following procedure outlines how to use the 2209 to perform Terminate Receive Call. The Signalling Option is required.

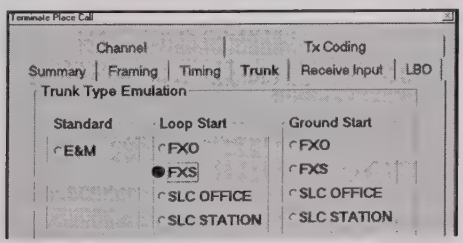
1. Press **TERM**. Then, select **Terminate Receive Call** from the pull-down menu. The unit automatically configures to a default setup screen.



2. Press **Setup**. Ensure characteristics shown in the setup **Summary** screen match the network characteristics. To change settings, select the desired property sheet tabs in the property setup sheets.

3. Select **Channel** tab in property sheet to choose the T1 channel (DS0) on which to transmit the signaling.

4. Select the appropriate trunk type (e.g., Loop Start, Ground Start, or E&M) using the **Trunk** tab. If Loop Start or Ground Start is selected, choose **FXS** or **SLC Station** (with SLC Framing) as the type of card emulation. Press **OK**.



5. Connect a cable from the PRIMARY RX jack to the IN jack of the DSX-1. Connect a cable from the PRIMARY RX jack to the OUT jack of the DSX-1.

6. Press the **RESTART** permanent softkey to clear alarms. Verify the SIGNAL and FRAME LEDs are illuminated (green).

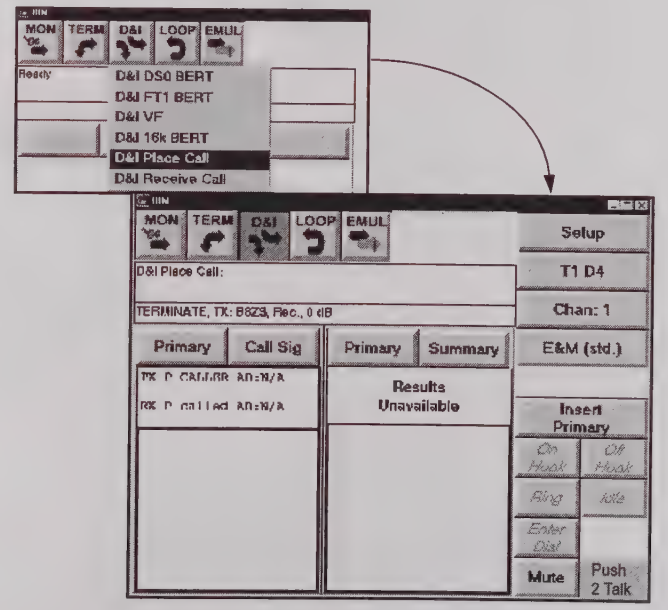
7. Select **Call Sig** Results CATEGORY display beside the Primary Results GROUP selection. Verify that **On Hook** and **Off Hook** are observed in **Call Sig** Results CATEGORY display.

8. Observe call sequence events as the call is established.

3.13 T1 DROP AND INSERT SETUP (PLACE CALL)

The Signalling Option is required for this D&I (drop and insert) test.

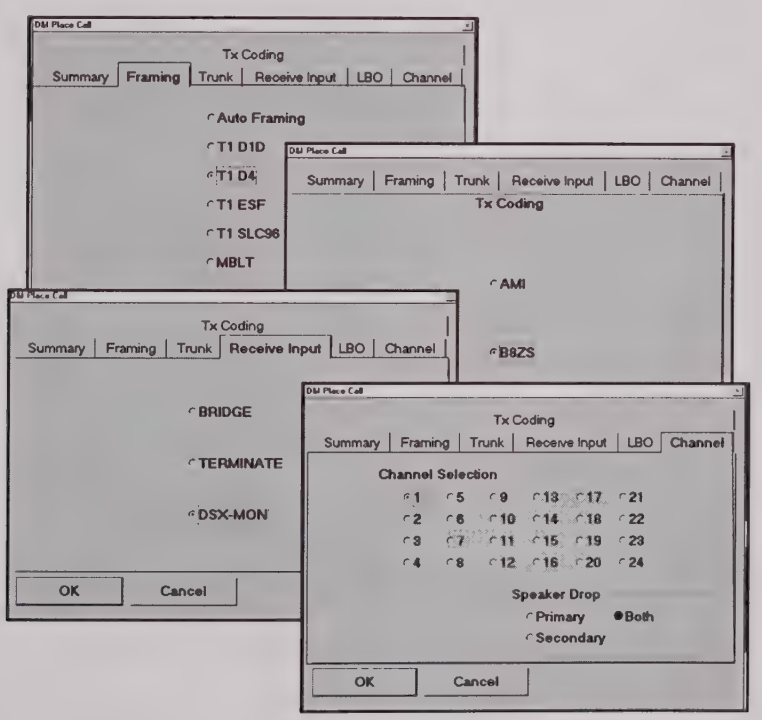
1. Select **D&I**. Then, select **D&I Place Call** from the pull-down menu. The 2209 configures to a default setup.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** setup screen match the network characteristics.

3. To change baseline settings, select the desired property sheet tabs in the Property Setup sheets. Select appropriate T1 **Framing**, **Tx Coding**, **Receiver Inputs**, and **Channel** to appropriate Channel and Speaker Drop.

4. Select the appropriate trunk type (standard E&M, Loop Start, Ground Start). If Loop Start or Ground Start is selected, choose **FSX** or **SLC** (with SLC framing) as the type of card emulation. Press **OK**.



5. Connect a cable from the PRIMARY RX jack to the appropriate DSX-1 A-Side MON jack (see Figure 3-4).

NOTE

In Figure 3-4, *black cables are Primary connections, and gray cables are Secondary connections.*

6. Connect a cable from the Secondary RX jack to the appropriate DSX-1 Z-side MON jack (see Figure 3-4).

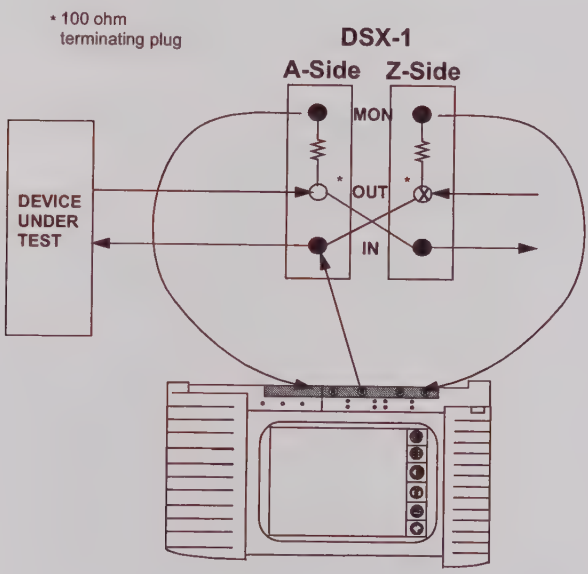
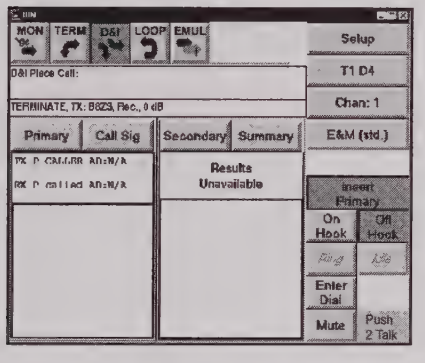


Figure 3-4. Simulation Drop and Insert Setup

7. Simultaneously, connect a cable from the Primary TX jack to the appropriate DSX-1 A-side IN jack (Figure 3-4) while inserting a 100 ohm terminating plug into the DSX-1 Z-side OUT jack.
8. Press the **RESTART** permanent softkey to clear alarms.

   Verify the Primary and Secondary SIGNAL and FRAME LEDs are illuminated and the Primary and Secondary Results display shows RESULTS OK (under **Summary** CATEGORY).
9. Press **Insert Primary** and then **Enter Dial** to bring up the numerical keypad.

10. Select **Call Sig** Results CATEGORY display. Verify that **ON Hook** is observed in the **Call Sig** Results CATEGORY.



ACTION buttons enable variances in testing. Use them for ON Hook, Off Hook, Ring, Idle, access to the Keypad (Enter Dial), and Mute.

11. Press the **Off Hook** ACTION button. Verify that **Off Hook** appears in the Results display, followed by either a **WINK** (on standard E&M trunks) or **Dial Tone** (on Loop and Ground Start trunks).
12. Dial test number on the numeric keypad.
13. Press **ON Hook** to complete the call.
14. Select **Chan: X** Quick Configuration key to select another DS0 channel to test.
15. Repeat procedures from Step 11- 14 to continue testing remaining DS0 channels.
16. Disconnect from the circuit in the reverse order to prevent service disruption.

3.14 TESTING INTELLIGENT REPEATER SPANS

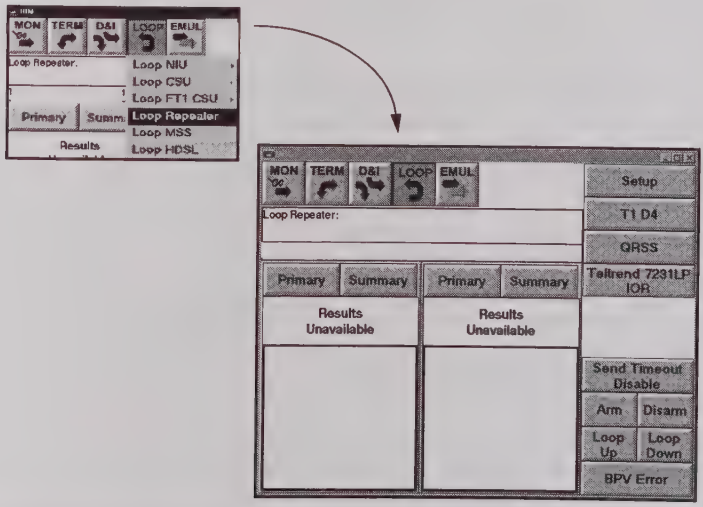
The following test application provides an example of how you can sectionalize addressable repeater spans by transmitting appropriate pre-programmed loop codes from the Central Office (CO). Testing intelligent repeater spans requires the ILE Option.

The ILE option provides the intelligent span equipment loop codes used to loop up and loop down individual, addressable, office repeaters and line repeaters, or to transmit maintenance switch commands.

The following devices can be armed, disarmed, queried, and looped back when the ILE option is installed.

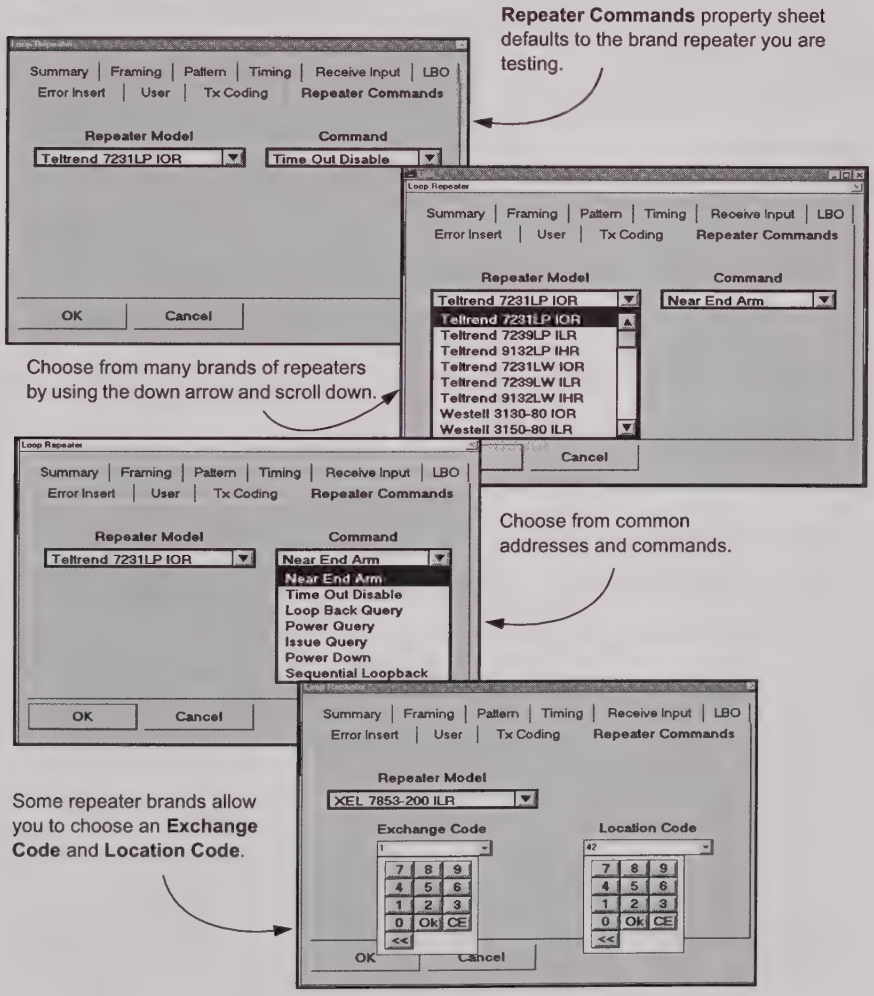
- Teltrend Model 7231LP IOR/ 7239LP ILR Intelligent Repeaters
- Teltrend Model 9132LP IHR Intelligent Repeater
- Teltrend Model 7231LW IOR / 7239LW ILR Intelligent Repeaters
- Teltrend Model 9132LW IHR Intelligent Repeater
- Westell 3130-80 IOR Intelligent Repeater
- Westell 3150-80 ILR Intelligent Repeater
- Westell 3150-81 ILR Intelligent Repeater
- Westell 3150-56 ILR Intelligent Repeater
- Westell 3151-56 ILR Intelligent Repeater
- Westell 3130-56 IOR Intelligent Repeater
- XEL 7853-200 ILR Intelligent Repeater
- Westell 3171 T1 Network Interface and Maintenance System (60 Series)

1. Press **LOOP**. Then select **Loop Repeater** from the pull-down menu. The 2209 automatically configures to a default setup for the chosen application.

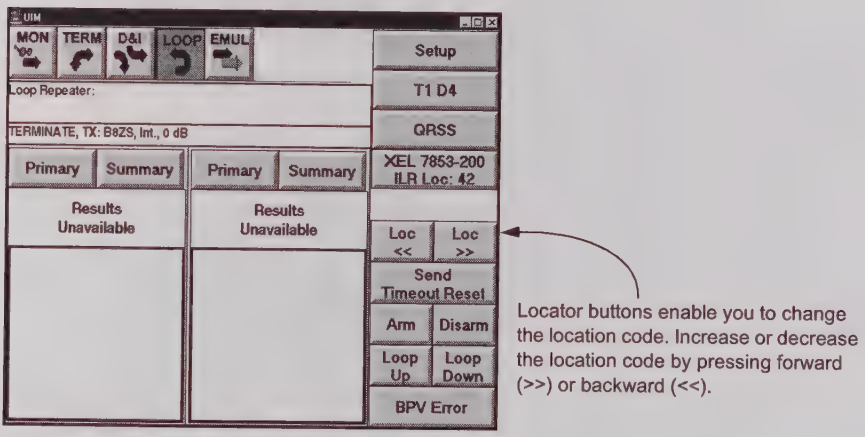


2. Press **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics. To change the settings (e.g., framing, pattern, and timing), select the desired property tabs in the property setup sheets.

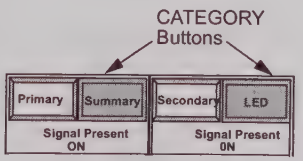
3. Select the **Repeater Command** property sheet tab. This tab enables you to select the appropriate model repeater type and address as well as any special commands (e.g., time out disable and power query).


Repeater Commands property sheet defaults to the brand repeater you are testing.
Summary | Framing | Pattern | Timing | Receive Input | LBO
Error Insert | User | Tx Coding | Repeater Commands
Repeater Model
Teltrend 7231LP IOR
Command
Time Out Disable
OK
Cancel
Choose from many brands of repeaters by using the down arrow and scroll down.
Teltrend 7231LP IOR
Teltrend 7239LP ILR
Teltrend 9132LP IHR
Teltrend 7231LW IOR
Teltrend 7239LW ILR
Teltrend 9132LW IHR
Westell 3130-80 IOR
Westell 3150-80 ILR
Near End Arm
Choose from common addresses and commands.
Near End Arm
Time Out Disable
Loop Back Query
Power Query
Issue Query
Power Down
Sequential Loopback
Some repeater brands allow you to choose an Exchange Code and Location Code.
XEL 7853-200 ILR
Exchange Code
Location Code

4. Press **OK.** If you chose a repeater that has **Location Code** capability, the setup screen will look similar to this:



5. Connect a cable from the PRIMARY RX jack to the span-side DSX-1 OUT jack.
6. Connect a cable from the PRIMARY TX jack to the span-side DSX-1 IN jack.
7. Set the left Result CATEGORY to **Summary** and the right Result CATEGORY to **LED**.



8. Press the **ARM** ACTION button to arm the span and provide a loopback at the NIU. The following LEDs should be illuminated (green): SIGNAL, FRAME, PATTERN. **Summary** display should show RESULTS OK. Insert a few errors by pressing the Error Insert ACTION button (e.g., **BPV)** at lower right of screen.
9. If errors are detected or the LEDs are not illuminated correctly, record the types of errors to determine symptoms of the span problem and then sectionalize the span to determine location of the fault(s).

Sectionalization Procedure:

10. Press **LOOP UP** to send the addressable repeater loop-up code to the specified mid-span repeater. Observe Message Display for messages regarding the transmission of the loop code. Verify that SIGNAL, FRAME, PATTERN LEDs are illuminated (green).
11. Press **LOOP DOWN** to send the addressable repeater loop-down code to the specified mid-span repeater. Observe Message Display for messages regarding the transmission of the loop-down code.
12. Determine new addressable repeater address (if necessary) by pressing **Addr <<** or **Addr >>**. This action increments or decrements the repeater address until it matches the selected addressable repeater.
13. Repeat steps 8-10 until the location of the problem has been isolated between two or three repeaters. Then press **LOOP DOWN**, followed by **DISARM** to end test.

Refer to Table 3-3 for definitions of commands possible from the **Repeater Commands** property sheet.

Table 3-3. Repeater Commands for Loop Code Tests

Command	Definition
Near-End Arm	A near-end arming code is transmitted on the intelligent repeater span when testing from the NIU toward the CO to prepare the intelligent repeaters to loop up or loop down upon receipt of the appropriately addressed loop codes.
Time Out Disable	Disables the loopback, time-out function of the repeater. Establish the line repeater loopback first, then send **Timeout Disable**. Timeout resets when the loopback is deactivated remotely.
Loopback Query	Returns address of the repeater that is in loopback.
Power Query	Returns address of the repeater that is currently looping back the power.

Table 3-3. Repeater Commands for Loop Code Tests (Continued)

Command	Definition
Issue Query	Returns the issue (revision) of the repeater.
Sequential Loopback	Loops up/down T1 line repeaters on the span in sequence starting with the repeater nearest the 2209, and proceeds down the span, regardless of the repeater's address. Pressing **Send Seq Loopback** transmits the sequential loopback code. The first time a repeater receives this code, it loops up and returns its address. The second time the sequential loop code is sent, the repeater loops down (or loops down and loops up the next repeater).
Power Down	Removes power from the line past the office repeater while the loop code is being transmitted (plus an additional five seconds after the loop code transmission is stopped). This function is typically used to reset the line, particularly if a repeater in loopback cannot be looped down via commands. **Warning: Do not use this function to work on the line.**

3.15 USING VT100 EMULATION

The 2209 can be configured to perform VT-100 terminal emulation. For this function, the VT100 option is required.

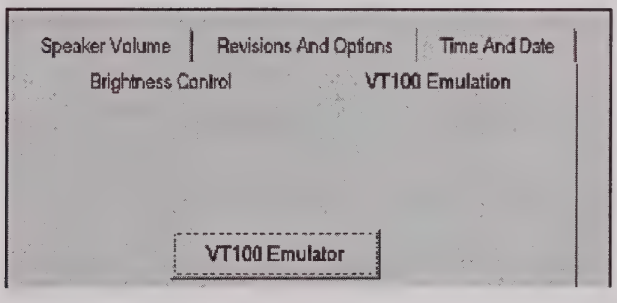
In this mode, you can locally access network components, such as HDSL units or performance monitoring devices (e.g., PMNIU or PMDNI), and provision them or obtain performance information from them. When the VT100 Option is installed in your 2209, there is no need to carry a laptop computer to do VT100 emulation.

VT100 Setup Procedure:

1. Connect the supplied RS-232 interconnect cable from the printer port on the 2209 to the network device under test (e.g., HDSL unit). If necessary, connect a "gender changer" to the DB-9 connector end.

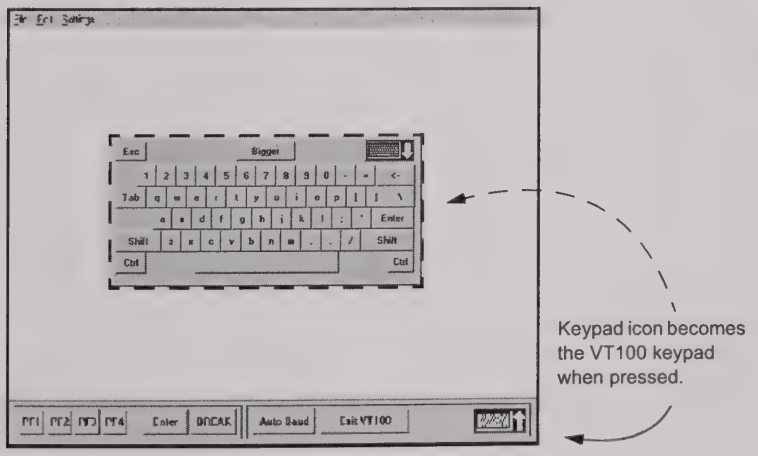
2. Access the VT100 emulator by pressing the **Auxiliary** permanent softkey icon (FILE CABINET).

3. Press **VT100 Emulation** tab in the auxiliary functions screen, followed by **VT100 Emulator** in the middle of the screen.

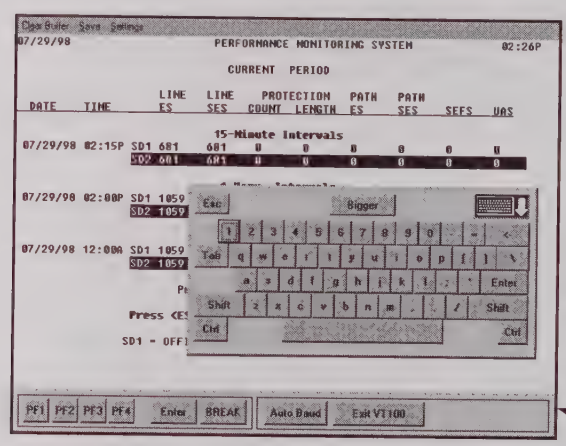


The screen turns into a VT100 terminal with a cursor blinking at the top left hand corner.

4. Press the keypad icon located on lower right of the screen to access the keypad.



5. Change the size of the keypad by clicking the **Bigger/Smaller** button on the keyboard. You can also move/drag the keyboard to any desired location.

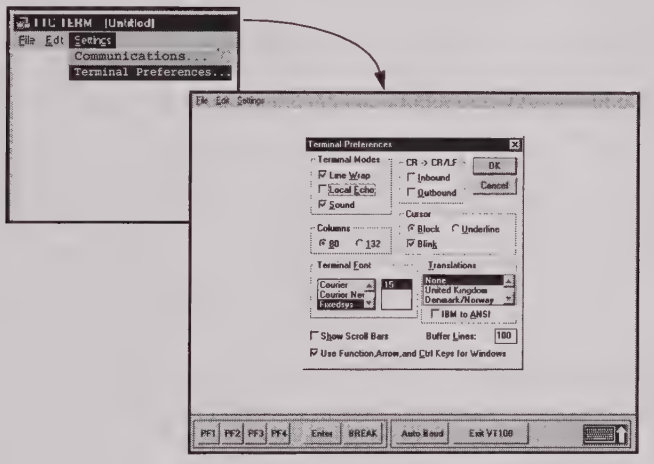


VT100 Keypad used during performance monitoring. Notice the Keypad Icon has moved from status bar onto pop-up keypad.

To access the menu of the network unit, either wait a few seconds (e.g., Westell devices) or press the **<ESC>** key (e.g., Teltrend devices). Often, pressing the space bar works. If nothing appears on the screen after trying the above procedures:

- Press **Settings** from the main menu bar
- Press either **Terminal Preferences** or **Communications** from the pull-down menu.
- Ensure settings are correct.

For example, in the Terminal Preferences screen, you may want to have **Local Echo** turned off, especially if double characters are appearing on the screen. If settings are incorrect, change and save the settings. Try step 6 again.



NOTE

In the Communications Screen, NO NOT change the ***Connector*** *setting. The setting is correct for the application.*

The menu for the network unit should appear and the format should be correct. If not, go back to **Settings/Terminal Preferences** and check the **CR/LF** insert. You may want to move or minimize the keypad at this time. To minimize keypad, press keypad icon.

6. Perform operation(s) according to menu selections of the network device connected to the 2209 VT100 Emulator.
7. Minimize keyboard.
8. Press **Exit VT100** to exit VT100 Emulation.

3.16 USING TESTMATE

For this function, the TestMATE Option is required.

In this mode, the 2209 uses built-in intelligence that acts as an interactive guide for testing T1. It enables auto-configuration setup, auto-test capability, and results interpretation to simplify trouble-shooting. By selecting the **TestMATE** icon, you can execute two types of test sequences: TestPad Intelligent Test or User-Configured Test.

The **TestPad intelligent Test** allows the 2209 to run a predefined test sequence that gathers and displays intelligent diagnostic information based on preceding results. A pre-configured test mode produces a pre-programmed sequence, including a loop up code and several BERT patterns.

The **User-Configured Test** allows the 2209 to implement more sophisticated tests wherein you select any variable of framing, line coding, loop code, and your preferred selection of patterns and associated test durations.

Both uses of TestMATE are an automated T1 turn-up test, complete with prompts for line coding and framing screens. Both use multiple pattern stress tests, following up with comments on errors found in the network. Based on test results collected, the 2209 exhibits an interactive tutorial, suggesting some next steps for you to try, and indicates areas to further investigate with "point and click" ease.

3.17 USING TESTPAD INTELLIGENT TEST

Using the TestPad Intelligent Test, you can perform the following operations:

- **Perform Loopback** — Automatically sends the appropriate loop back command and waits for a response. If a loop back is established, the test continues. If not, the loop command initiates again. The test stops after two failed attempts.
- **Perform Continuity Check** — Sends five bit errors in order to establish continuity.
- **Perform BERT Testing** — Sends a sequence of patterns based on an intelligent Acterna developed flow chart.

- **Report Intelligent Results** — Displays either a successful test completion message or a description of the possible fault.
- **Record the Results** — Provides the ability to record the results onto a PCMCIA card.

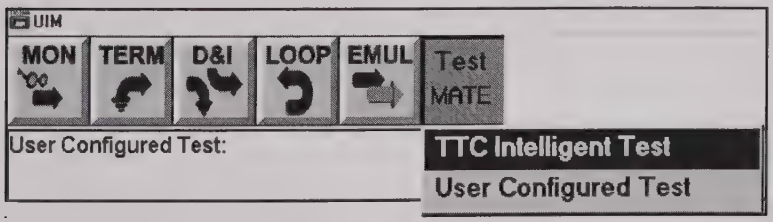
3.17.1 TestPad Intelligent Test Configuration

It is necessary to select from the following parameters to test the circuit. Included in your choices are:

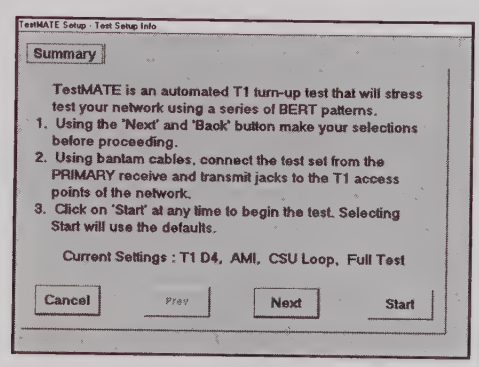
- **Framing** — ESF or D4.
- **Tx Coding** — AMI or B8ZS.
- **Loop Code** — Equipment to be looped back. You can choose any of the following:
  - CSU loop codes
  - NIU loop codes
  - None — Programmable loop codes defined on the PCMCIA card — these include the option to send the loop code on either the payload or the ESF data link.
- **Duration** —
  - Full — Each pattern can be run for five minutes.
  - Fast — Each pattern can be run for two minutes
  - Other —Each pattern can be run for a user-defined time (respectively).

TestMATE TestPad Intelligent Test Setup Procedure:

1. Select **AUX**. Then, select **TestPad Intelligent Test** from the pull-down menu.

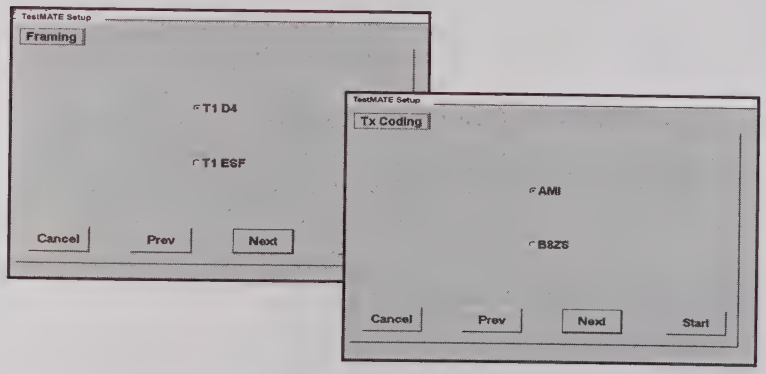


2. A **Summary** setup screen displays preliminary instructions regarding pre-test setup/configuration. Click **START** to begin the test using default settings. **Next** and **Back** allow you to traverse through additional setup pages (either direction) to change settings.


TestMATE Setup - Test Setup Info
Summary
TestMATE is an automated T1 turn-up test that will stress test your network using a series of BERT patterns.
1. Using the 'Next' and 'Back' button make your selections before proceeding.
2. Using bantam cables, connect the test set from the PRIMARY receive and transmit jacks to the T1 access points of the network.
3. Click on 'Start' at any time to begin the test. Selecting Start will use the defaults.
Current Settings : T1 D4, AMI, CSU Loop, Full Test
Cancel
Prev
Next
Start

3. Click **Next**. A **Framing** property sheet appears with the current framing (default is T1 D4). If required, select the framing type.

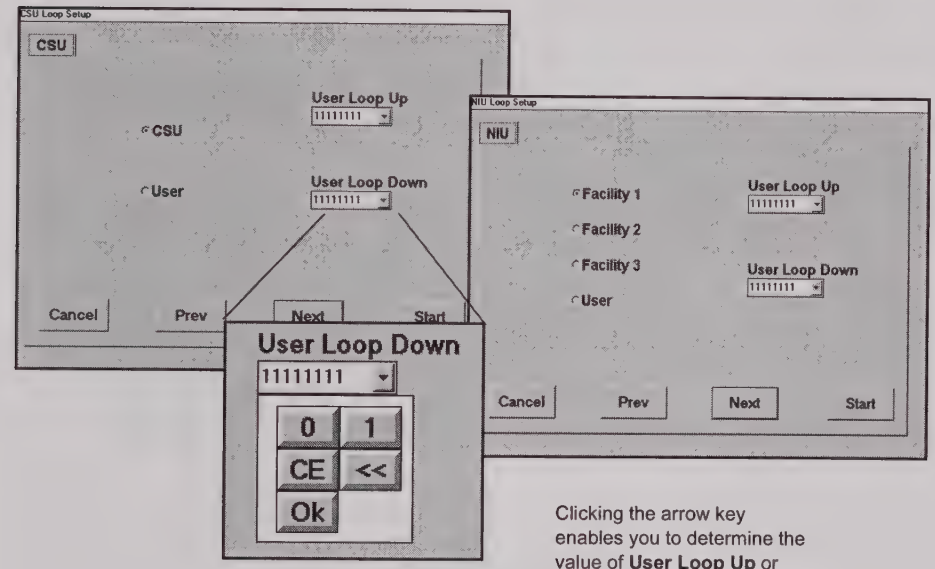
4. Click **Next**. A **TX Coding** tab appears with the current loop code (default is AMI). If required, select the loop code type.



5. Click **Next**. A **Loop Type** tab appears with the current loop code (default is CSU Loop). If required, select the loop type. If you chose **CSU Loop** or **NIU Loop**, you may select either **Start** or **Next**. If you select **Next**, a **Test Duration** tab appears with predetermined times. You can choose:

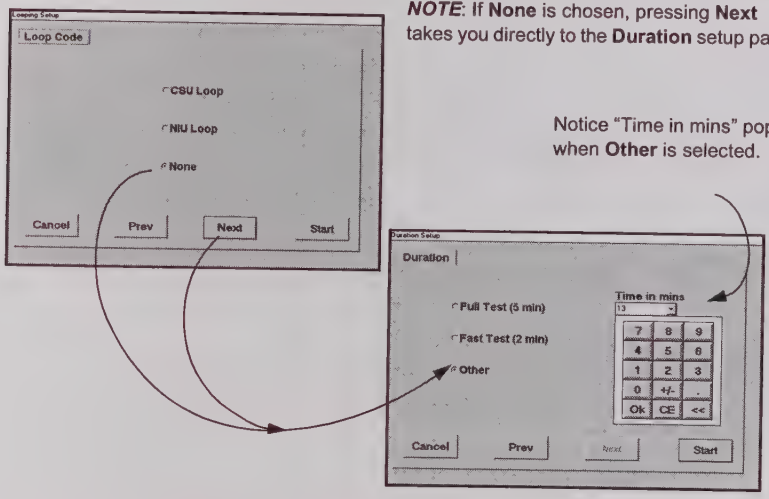
   - **Full Test** — runs for 5 minutes per pattern.
   - **Fast Test** — runs for 2 minutes per pattern.
   - **None** — runs for as many minutes per pattern as you determine.

Depending upon the **Loop Type** (CSU Loop, NUI Loop, or None), you can choose from the following loop codes.



Clicking the arrow key enables you to determine the value of **User Loop Up** or **User Loop Down**.

Choosing **None** takes you directly to the **Duration** setup page. If **Other** is chosen here, a pop-up window appears enabling you to set the amount of time you want the test to run.



NOTE: If **None** is chosen, pressing **Next** takes you directly to the **Duration** setup page.

Notice "Time in mins" pop-up when **Other** is selected.

6. Click **Start**. A message reading `Sending Facility Loop Up Code` displays, meaning the test has initiated. After engaging, the following screen displays real-time results of turning up T1.

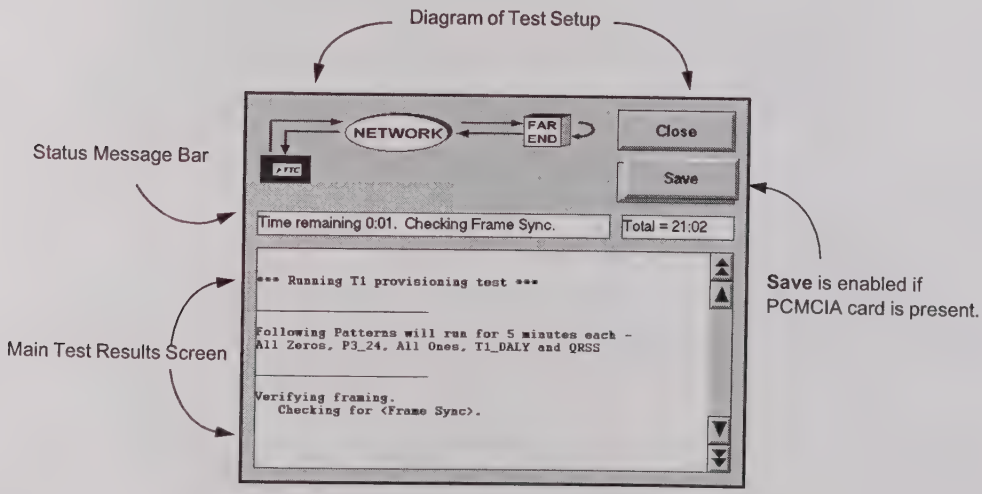
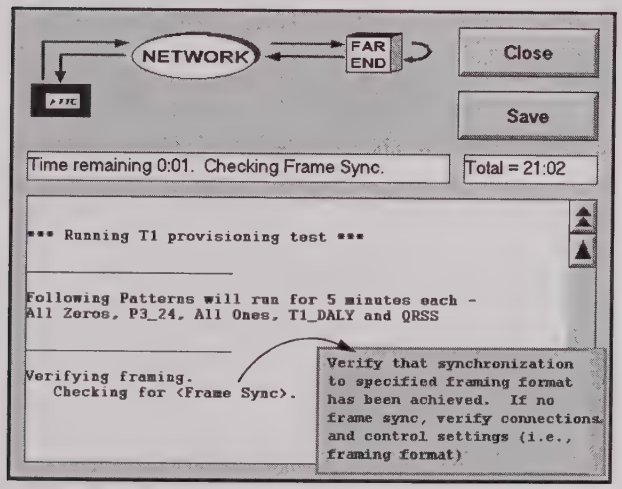


Diagram of Test Setup
Status Message Bar
Main Test Results Screen
NETWORK
FAR END
Close
Save
Time remaining 0:01. Checking Frame Sync.
Total = 21:02
*** Running T1 provisioning test ***
Following Patterns will run for 5 minutes each -
All Zeros, P3_24, All Ones, T1_DALY and QRSS
Verifying framing.
Checking for <Frame Sync>.
Save is enabled if PCMCIA card is present.

At this point, the 2209 automatically runs a series of T1 turn-up tests. After verifying the framing, it will initiate a stress test consisting of multiple test patterns. If no errors are found, TestMATE returns a `T1 Pipe is good` message.

If errors are detected, `Test encountered ERRORS` displays in the message bar. Based on the test results collected, which are also displayed, the 2209 suggests some next steps or indicates areas to further investigate. Additionally, text-sensitive help is provided. Click on the words between the **< >** symbols for more information. A pop-up text box appears in the window and provides supplemental information for real-time tutorial usage.


NETWORK
FAR END
Close
Save
Time remaining 0:01. Checking Frame Sync.
Total = 21:02
*** Running T1 provisioning test ***
Following Patterns will run for 5 minutes each -
All Zeros, P3_24, All Ones, T1_DALY and QRSS
Verifying framing.
Checking for <Frame Sync>.
Verify that synchronization to specified framing format has been achieved. If no frame sync, verify connections and control settings (i.e., framing format)

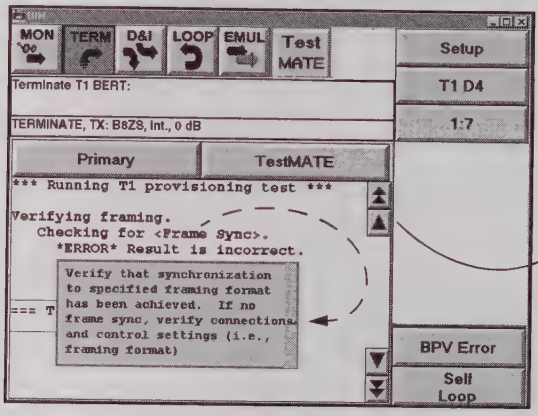
Click on <Frame Sync> to get pop-up for frame synchronization

7. When testing is completed, press **Close.**

If you press **Close,** you go back to the main screen where the Result GROUP (set to **Primary**) and CATEGORY (set to **TestMATE**) automatically display after running the test. You can scroll up or down the screen using arrows in the display while reading the results of the test. Again, as in the above property sheet test screen, you can click on the word(s) between the **< >** symbols for more information. A pop-up text box appears to provide supplemental information, prompting alternative action for more testing.

NOTE

***Save** is not available for **TestPad Intelligent Test** or **User Configured Test** unless PCMCIA card is present.*



Click on word(s) between < > for pop-up help on main screen. You can also use up/down arrows to scroll the text on the results display window. To continue testing, press **TestMATE** to resume testing.

3.18 USER CONFIGURED TEST

The second menu option under **TestMATE** is the **User Configured Test.** Under this option a pop-up menu shows the current test available which the user can select and either use them or reconfigure them. A choice to create a new test is also available. For, both creating a new test setup or editing the existing setup the user has to go through the same steps as shown as explained in Section 3.17, *Using TestPad Intelligent Test.*

Selecting **User Configured Test** enables you to perform the following operations:

- **Program and Name a Test Sequence** — Program a sequence of events to perform the test including selecting a framing type, a line coding type, a loop code, and the order and duration of patterns. This has the added benefit of enabling you to select a descriptive name for the test.
- **Perform Loopback** — Automatically sends the pre-programmed loop back command and waits for a response. If a loop back is established, the test continues. If not, the loop command initiates again. The test stops after two failed attempts and prompts a pre-configured comment that describes the type of loop code and why it is being sent.
- **Perform Continuity Check** — Sends five bit errors in order to establish continuity.
- **Perform BER Testing** — Sends the pre-programmed sequence of patterns.
- **Record the Results** — Provides the ability to record and save the results onto a PCMCIA card.

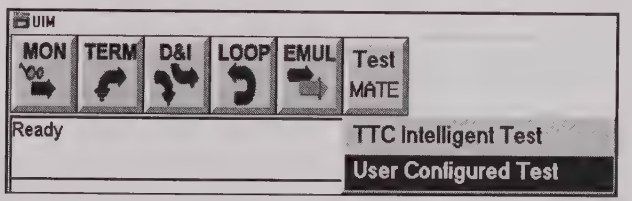
3.18.1 User-Configured Test Configuration

Selecting the option to run a pre-programmed test sequence gives you more parameters to choose from when running a T1 turnup. You have a list of available test names and the option to create a new test. If you create a new test, you are guided through a series of screens enabling selection of framing type, coding type, loop code type, sequence of patterns with variable durations, and your own descriptive name for the test. Of course, you can also select an existing test with the added benefit of having the option to modifying it to suit your purpose. Additionally, you can save any new or modified test sequence on a PCMCIA card.

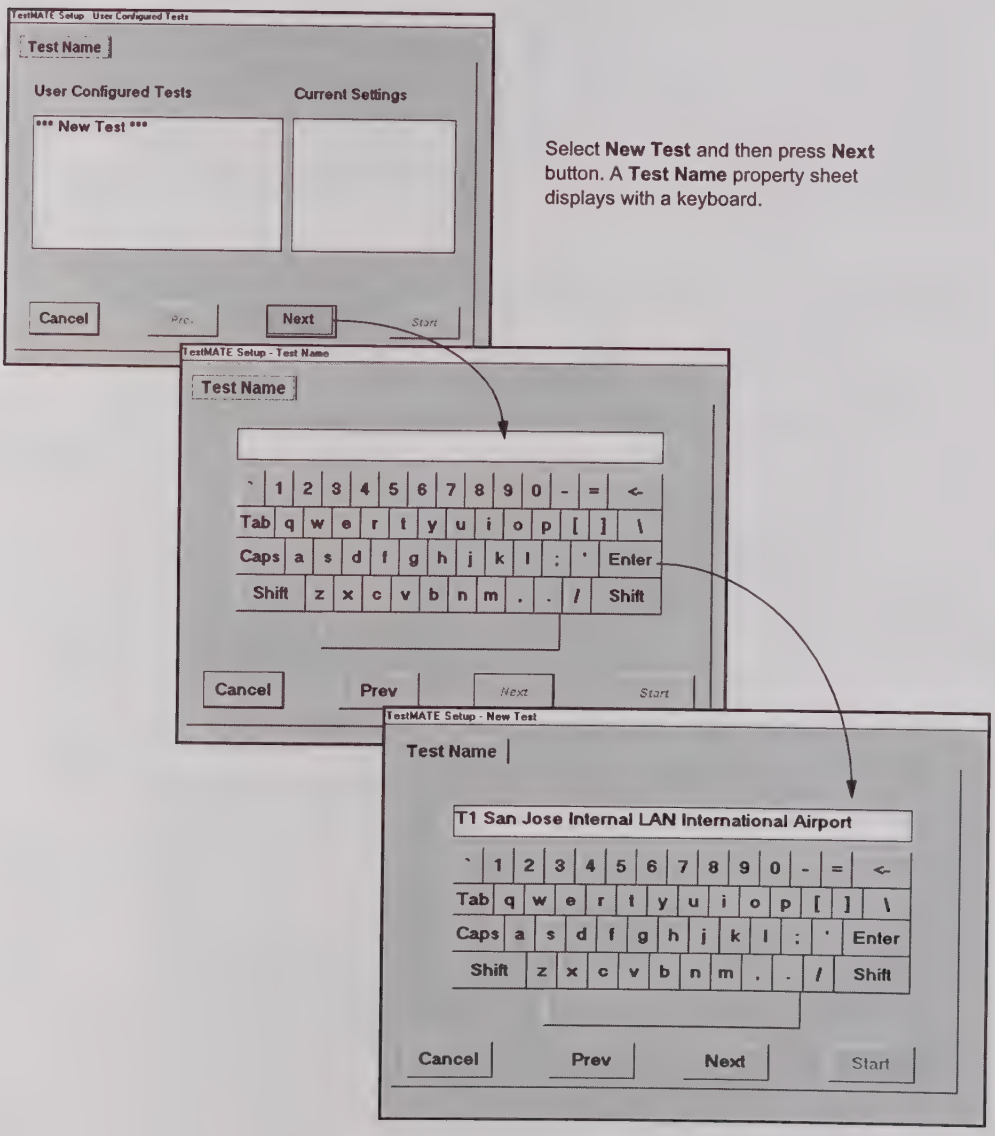
After a test is created on a PCMCIA card, use a PC-based editor to modify its configuration file. This enables the possibility of adding descriptive comments and feedback gathered during a test.

User-Configured Test Setup Procedure:

1. Select **TestMATE**. Then, select **User Configured Test** from the pull-down menu.

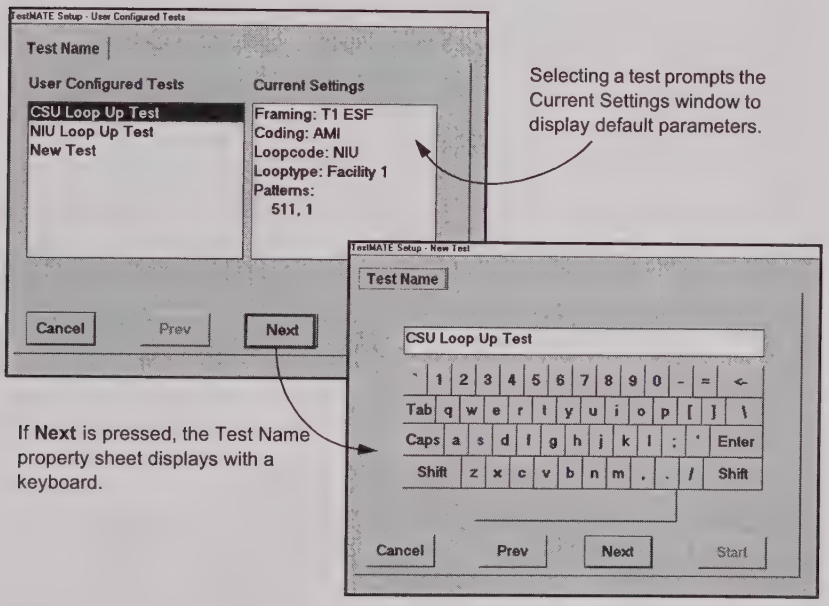


2. Choose a pre-programed test or create a new test sequence.
   a. If you select **New Test**, the following screens enable easy capability to name the test.



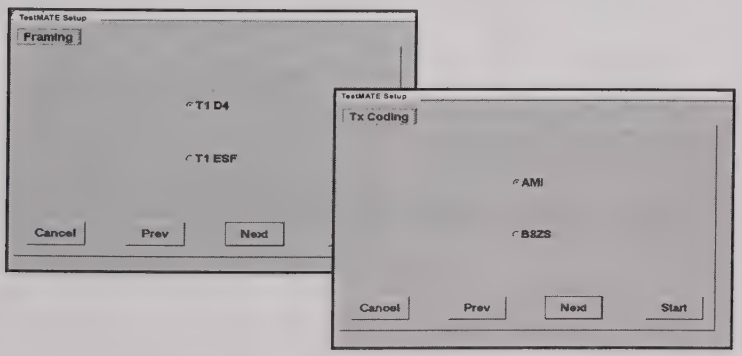
Select **New Test** and then press **Next** button. A **Test Name** property sheet displays with a keyboard.

b. If you select an existing test such as **CSU Test Loop Up** or **NIU Test Loop Up,** as shown in this example, the following screens enable easy capability to check current settings and check the name or customize it.

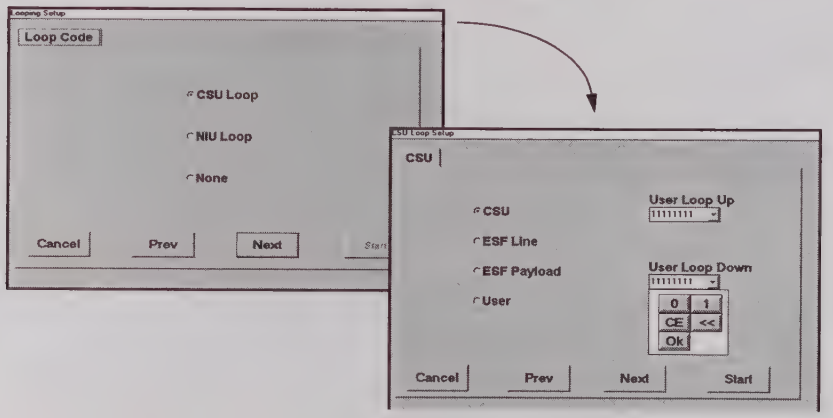


3. Click **Next**. A **Framing** property sheet appears with the current framing (default is T1 D4). If required, select the framing type.

4. Click **Next**. A **TX Coding** tab appears with the current loop code (default is AMI). If required, select the loop code type.

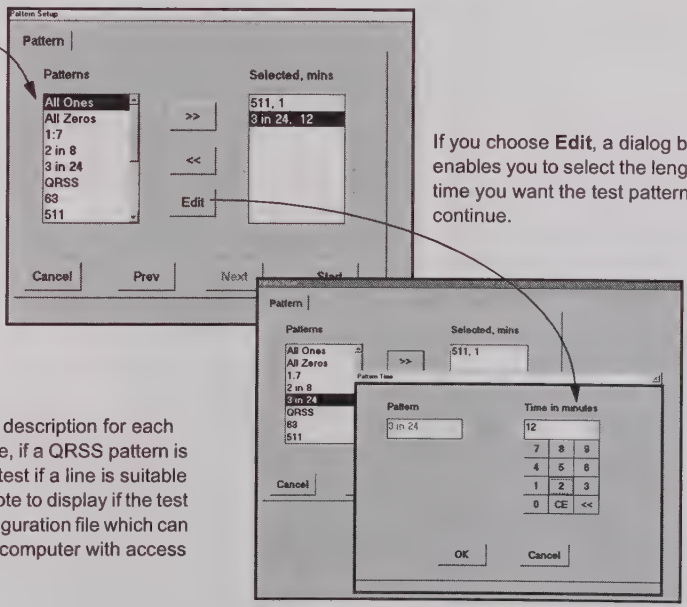


5. Click **Next**. A **Loop Type** tab appears with the current loop code (default is **CSU Loop**). If required, choose from any of the standard loop codes.



6. Click **Next**. A **Pattern** tab appears enabling you to select any pattern for any duration.

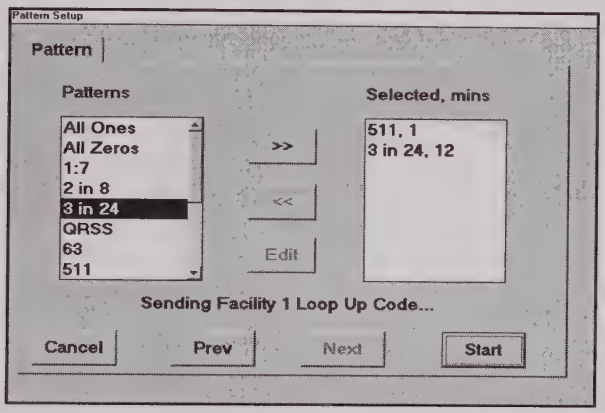
Choose patterns from the left window. Use right/left arrows above **Edit** button to select or deselect patterns.



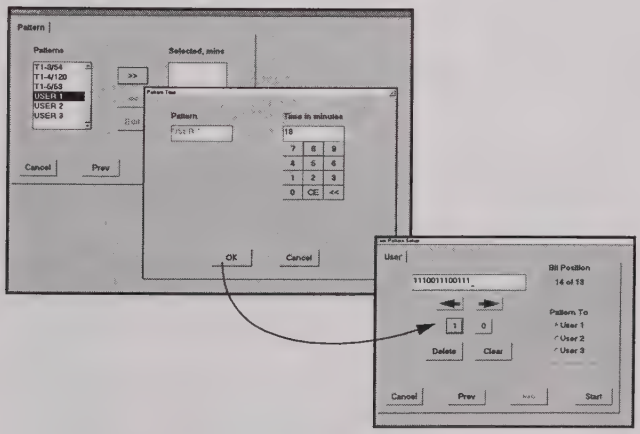
If you choose **Edit**, a dialog box enables you to select the length of time you want the test pattern to continue.

You can also define an error description for each pattern selected. For example, if a QRSS pattern is added to a test sequence to test if a line is suitable to run voice, you can add a note to display if the test fails. Do this through the configuration file which can be modified from a personal computer with access to a PCMCIA card reader.

7. Click **Start**. A message displays, indicating the test has initiated and a loop code is being sent.

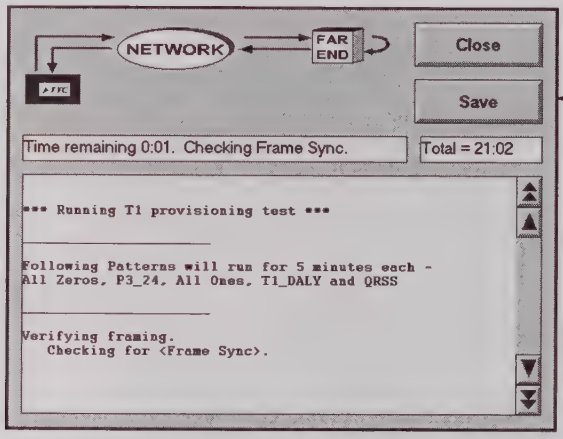


8. If patterns **User 1**, **User 2**, or **User 3** are selected, then a pop-up screen enables you to set the time for it to run. Pressing **OK** prompts the **User Pattern Setup** page where you can customize the bit pattern you want to send.



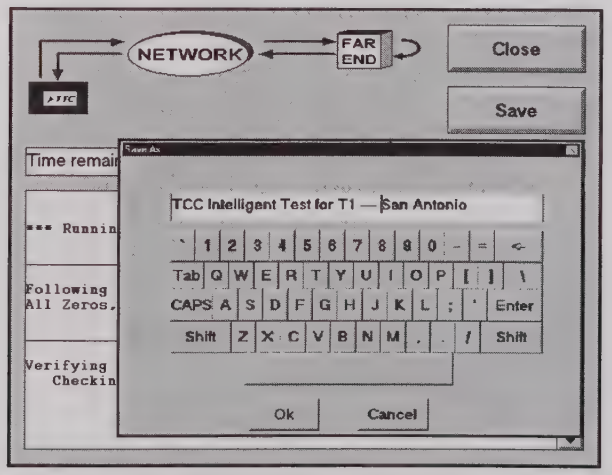
After engaging, the following screen displays the real-time results of turning up T1.

9. When testing is completed, press **Close** or **Save.**


NETWORK
FAR END
Close
Save
Time remaining 0:01. Checking Frame Sync.
Total = 21:02
*** Running T1 provisioning test ***
Following Patterns will run for 5 minutes each -
All Zeros, P3_24, All Ones, T1_DALY and QRSS
Verifying framing.
Checking for <Frame Sync>.
(Remember, Save is active only if a PCMCIA card is present.)

If you press **Close**, you go back to the main screen where the Result GROUP (set to **Primary)** and CATEGORY (set to **TestMATE)** automatically display after running the test. You can scroll up or down the screen using arrows in the display while reading the results of the test. Again, as in the previous screen, you can click on the word(s) between the **< >** symbols for more information. A pop-up text box appears to provide supplemental information, prompting alternative action for more testing.

If you press **Save**, a dialog box appears enabling you to type in a name for the results file you want to save.



3.19 USING A PCMCIA CARD WITH TESTMATE

The ability to load and copy configurations, save test results, and program multiple units from a PCMCIA card makes using the supplied PCMCIA card with TestMATE a definite benefit. In fact, cannot save results unless a PCMCIA card is used. If the pre-programmed PCMCIA card is inserted into the 2209 upon startup, the TestMATE application verifies the TestMATE configuration file is available, and all tests display. Once programmed, the card can be permanently left in the 2209. To modify settings or change configurations, use a PC with a PCMCIA card reader. Any standard Windows editor can be used with a text editing program (such as NOTEPAD).

3.19.1 Saving Tests on a PCMCIA Card

When creating a new test using the graphical interface on the 2209, all key information pertaining to the test must be saved on a PCMCIA card. It is recommended that settings be saved to a single file; using one file removes the burden of having a file browser and allowing for directory structures. Also recommended is that each test be listed within this file with its own conventional T1 turn-up test name (avoids confusing one test with another).

The TestMATE T1 turn-up configuration file refers only to programmable codes. Application specific files, such as programmable patterns and loop codes, are read from application specific files.

When a test is originally created in the 2209, saved configurations include all information except the comment fields. Comments can be added at a later time using a text editor and a PC (see Section 3.19.2).

3.19.1.1 Sample TestMATE Configuration File

Using a PCMCIA card, the following example is a representation of how a configuration file looks when you type in a test sequence, and then save it as a TestMATE configuration file. We suggest calling the file *testmate.cfg*. In the following example, words in brackets are used to show you the essential components of a configuration file; a detailed description of file headings is in Table 3-4. The format of the file should be as follows.

Example File

```
[TESTMATE]
Testlist=T1
[T1]
; Name of up to 20 characters
Name= CSU Loop Up Test
```

```
; Framing can be {T1 ESF,T1 D4}
Framing=T1 ESF
; Coding can be {B8ZS, AMI}
Coding=B8ZS
; LoopCode can be {CSU, NIU, NONE}
LoopCode=NIU
; If NIU is selected, LoopType entry can be {Facility 1, Facility 2, Facility 3, ESF
Net}
; If CSU is selected, LoopType entry can be {CSU, ESF Line, ESF Payload}
LoopType=Facility 1
; List of patterns to be used for this test {All Ones, All Zeros, 1:7, 2 in 8,
; 3 in 24, QRSS, 63, 511, 2047, T1 DALY, 55 Octet, T1-2/96, T1-3/54, T1-4/120,
USER 1, USER 2, USER 3
; T1-5/53}
; Time is in minutes
PatternList=P1,P2,P2
P1=511
P1.Time=1
P2=QRSS
P2.Time=1
P3=USER 1
P3.Time= 2
User1Bit=1100
User2Bit=
User3Bit=
; Displayed at the beginning of a user-configured test
StartComment=This is the beginning of the test
; Displayed when the loop up code is being sent
LoopUpComment=NIU Facility one loop code sent to far end
; Displayed when the loop up code fails
LoopUpFailComment=Loop up command failed. Are you really connected to a Facil-
ity 1 NIU
; Displayed when a loop up code passes
LoopUpPassComment=Loop up successful. Rock on!
; Displayed when the loop down code is being sent
LoopDownComment=Sending NIU loop down code to return T1 to original state
; Displayed when the loop down code fails
LoopDownFailComment=Loop down failed. Call the Technical Assistance Center at
1 (800) 638-2049.
; Displayed when a loop down code passes
LoopDownPassComment=Loop down successful. Excellent!
; Pattern comments will be displayed whenever each pattern is sent
```

P1.Comment=Sending the all ones pattern to verify coding
; Displayed when the selected pattern either fails to get pattern sync or receives bit errors
P1.FailComment=All ones pattern detected errors. Is the coding optioned correctly?
; Displayed when the selected pattern pass its' BERT test
P1.PassComment=Coding optioned correctly.
; Displayed when one or more of the steps in the test fails
TestFailComment=This circuit did not pass the turn up test. Please perform extensive testing with the TB2209 or choose the 2310 for even more extensive testing.
; Displayed when all the steps in the user-configured test are completed successfully
TestPassComment=Turn up test successful.
; Displayed when the user selects the highlighted framing type
FramingHypertextComment=This checks sychronization to the selected framing format.
; Displayed when the user selects the highlighted line coding type
CodingHypertextComment=Verifies that the write coding type is selected for the circuit.
; Displayed when the user selects the highlighted loop up type
LoopUpHypertextComment=Sends a bit sequence to loop up the far end
; Displayed when the user selects the highlighted loop down type
LoopDownHypertextComment=Sends a sequence to loop down the far end.
; Displayed when the user selects the highlighted pattern
P1.HypertextComment=Send a BERT pattern to verify the integrity of the link.

Using the example in Section 3.19.1.1, refer to Table 3-4 to understand the file headings.

Table 3-4. Description of File Headings

Item	Description
File Header	Each file must begin with **[TESTMATE]**.
Testlist	First item in section — Each test section begins with the name of the test as the section heading. In above example, **[T1]** is the section heading.
Configuration Items	Variables which can be configured to perform a test, such as **Name**, **Framing**, **Loop-Code**, **Loop Type**, **Pattern List** (with at least one pattern), **Px** (for all patterns in pattern list), **Px.Time** (for all patterns in pattern list). **User1Bit**, **User2Bit**, **User3Bit** items are only required if a user pattern in used. All these configuration items can be created using the 2209 as long as a PCMCIA card is inserted.

Using the example in Section 3.19.1.1, refer to Table 3-5 to describe configuration variables.

Table 3-5. Description of Configuration Variables

Item	Variables	Description
Testlist	T1, T2, T3 (etc).	List of tests described in this file. This file contains test T1, T2, T3.
Name	Any text	Name of the test described in this section of the file.
Framing	{T1 ESF,T1 D4}	Framing type used.
Coding	{B8ZS, AMI}	Coding type used.
LoopCode	{CSU, NIU, NONE}	Loop code used.
LoopType	If NIU is LoopCode then {Facility 1, Facility 2, Facility 3, ESF Net}. If CSU is LoopCode then {CSU, ESF Line, ESF Payload}	Type of loop code used.
Pattern List	A comma delimited list in the form P1, P2, P3	List of patterns used.
Px	{All Ones, All Zeros, 1:7, 2 in 8, 3 in 24, QRSS, 63, 511, 2047, T1 DALY, 55 Octet, T1-2/96, T1-3/54, T1-4/120, USER 1, USER 2, USER 3; T1-5/53}	Pattern name used for pattern x where x is a number.
Px.Time	YY	The duration for pattern x in YY mins
User1Bit	{1,0}*	User loop code1 bits up to 24 bits
User2Bit	{1,0}*	User loop code 2 bits up to 24 bits
User3Bit	{1,0}*	User loop code 3 bits up to 24 bits

3.19.2 Adding Descriptive Comments to a User-Configured Test

You can program descriptive comments to display at each stage of a test using a PC and a standard editor (cannot be done from the 2209). The ability to have highlighted messages appear on the screen while running a test can be very helpful in determining whether the network is working correctly, and if it is not, to indicate (and list) any steps in the analyzing process which lead to its failure. The following comment items display during the progress of a test, and they are all optional. If you want to

modify comment items, remember to modify them by editing the *testmate.cfg* file on the PCMCIA card by using a standard text editor like NOTEPAD, otherwise a default comment displays. Comments can only be a single line of text as shown in the example file in Section 3.19.1.

Additionally, each of the comments described has a report number associated with it. These numbers display regardless of whether comment text exists on the PCMCIA card. Table 3-6 also shows the numbers used as a reference to indicate the progress of a TestMATE test.

Table 3-6. Description of Comment Item Variables

Comment Item Variables	Description	Report Number
StartComment	Comment displayed at the start of the test.	1
LoopUpComment	Comment displayed when the user selects the highlighted loop down type.	2
LoopUpFailComment	Comment displayed when the loop up code fails.	3
LoopUpPassComment	Comment displayed when a loop up code passes.	4
LoopDownComment	Comment displayed when the user selects the highlighted loop down type.	5
LoopDownFailComment	Comment displayed when the loop down code fails.	6
LoopDownPassComment	Comment displayed when a loop down is successful.	7
Px.Comment	Comment displayed whenever the pattern is being sent (x is the pattern number).	8
Px.FailComment	Comment be displayed when the selected pattern either fails to get pattern sync or receives bit errors. (x is the pattern number).	9
Px.PassComment	Comment displayed when the selected pattern passes its BERT test. (x is the pattern number).	10
TestFailComment	Comment displayed when one or more of the steps in the test fails.	11
TestPassComment	Comment displayed when all the steps in the user-configured test are completed successfully.	12
FramingHypertextComment	Comment displayed when the user selects the highlighted framing type.	13
CodingHypertextComment	Comment displayed when the user selects the highlighted line coding type.	14

Table 3-6. Description of Comment Item Variables (Continued)

Comment Item Variables	Description	Report Number
LoopUpHypertextComment	Comment displayed when the user selects the highlighted loop up type.	15
LoopDownHypertextComment	Comment displayed when the user selects the highlighted loop down type.	16
Px.HypertextComment	Comment displayed when the user selects the highlighted pattern. (x is the pattern number).	17

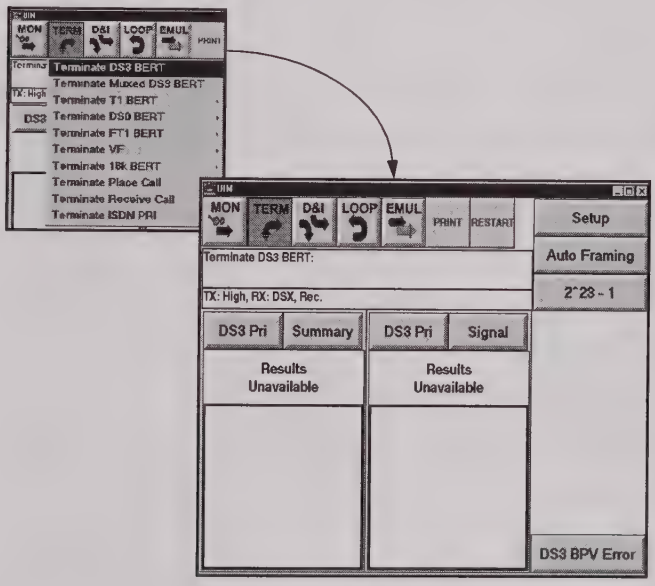
3.19.3 Saving Results on a PCMCIA Card

At the end of every test, you have the option of saving the results of the test to a PCMCIA card. You may use up to 20 characters (including digits and spaces). The results you are saving append to a results print file that contains all the information displayed on the screen, all the configuration information relating to the test, and a date and time stamp. Again, it is recommended to save to a single file. Lastly, available space on the card displays on the screen to indicate how much it can accommodate.

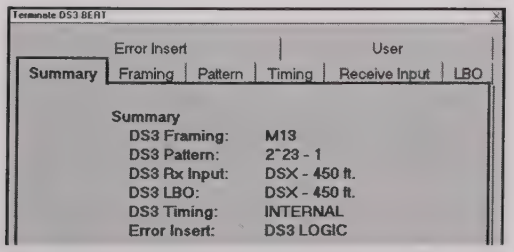
3.20 DS3 LOOPBACK BER TEST

Use the following procedures to use the 2209 to test DS3 circuits. The DS3 Option is required.

1. Press **TERM**. Select **Terminate DS3 BERT** from the pull-down menu. The 2209 automatically configures to a default setup for the chosen application.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** property setup screen match the network characteristics.



- Select proper framing (M13 or C-Bit).
- Select desired pattern.
- Set Timing to INTERNAL.
- Set LBO to DSX.
- Set Receive Input to DSX.
- Set Error Insert to DS3 LOGIC.

3. Press **OK**.
4. Loopback the far end of an out-of-service DS3 span at the DSX-3 patch panel (Figure 3-5).
5. Connect a cable from the DS3 PRIMARY RX jack to the near-end SPAN DSX-3 OUT jack.
6. Connect a cable from the DS3 PRIMARY TX jack to the near-end SPAN DSX-3 IN jack.
7. Press the RESTART permanent softkey to clear alarms and begin the test. Verify the SIGNAL PRESENT, FRAME SYNC, and PATTERN SYNC LEDs illuminate.
8. Press the **Error Insert** button five times to insert five logic errors. Verify looped back span by receiving five errors in the SUMMARY display.
9. Press the RESTART permanent softkey to clear alarms and begin a new test.
10. Record test results if errors are detected.

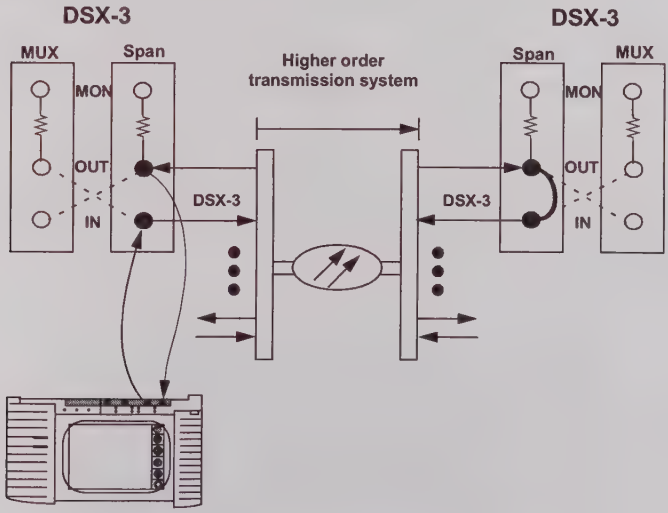
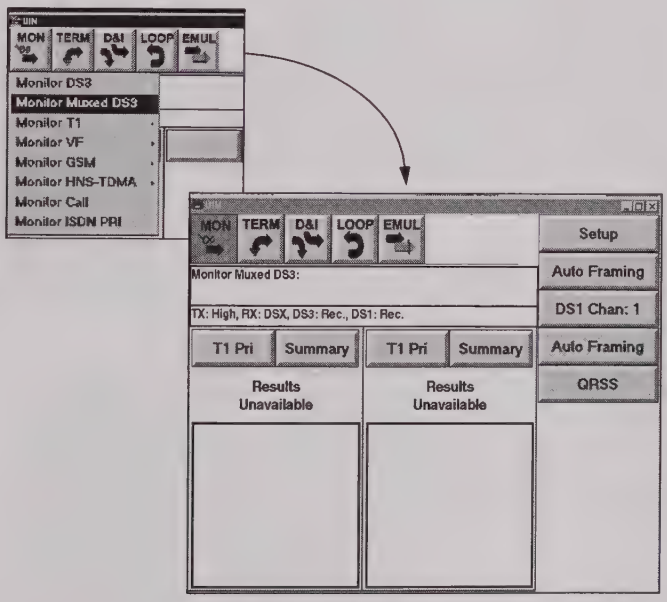


Figure 3-5. DS3 Loopback BER Test

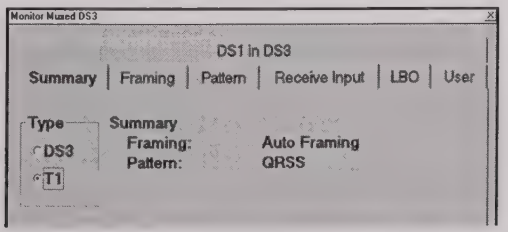
3.21 DS1 MONITOR TEST FROM DS3

Use the following procedures to use the 2209 to test DS1 from DS3 circuits. The DS3 option is required.

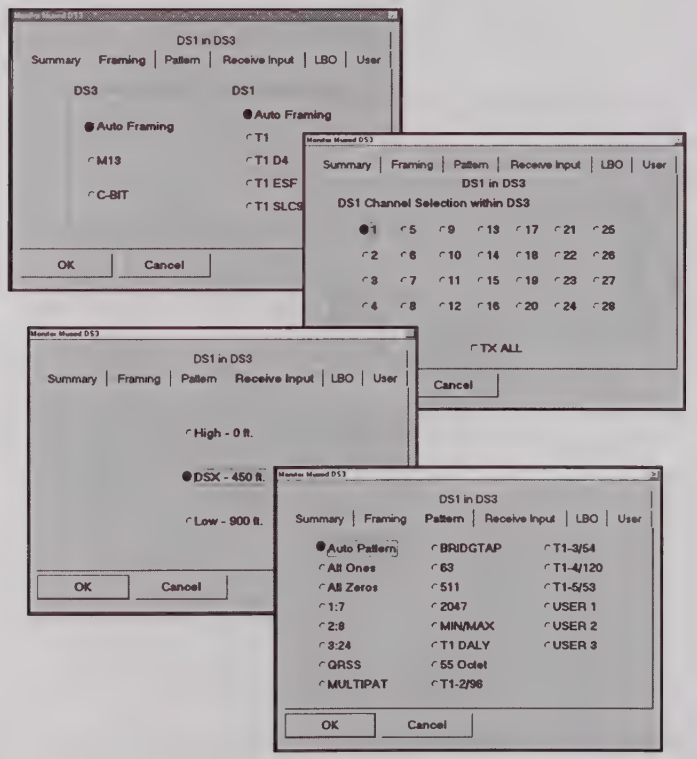
1. Press **MON**. Then, select **Monitor Muxed DS3** from the pull-down menu. The 2209 automatically configures to a default setup for the chosen application.



2. Press **Setup**. Ensure the characteristics shown in the **Summary** property setup screen match the network characteristics.



- Set **Framing** tab to DS3/DS1 Auto Framing.
- Set **Channel** tab to desired DS1 channel to be dropped.
- Set **Receive Input** tab to DSX.
- Set **Pattern** tab to Auto Pattern.



3. Press **OK**.
4. Connect a cable from the DS3 PRIMARY RX jack to the appropriate DSX-3 monitor point (see Figure 3-6).
5. Press the **RESTART** permanent softkey to clear alarms and begin the test. Verify the DS1 SIGNAL PRESENT and FRAME SYNC LEDs illuminate. Verify the following DS3 Status LEDs are illuminated: SIGNAL and FRAME.
6. Set right Result GROUP to **DS3 Primary.**

7. Set left Result GROUP **T1 Primary**.
8. Set Result CATEGORY buttons to **Summary**. Verify `RESULTS  OK` appears in both Category displays.

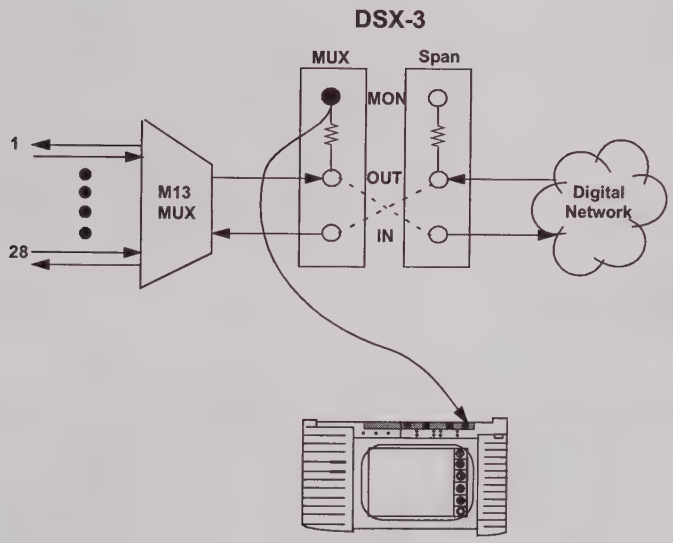


Figure 3-6. DS1 Monitor From DS3 Test

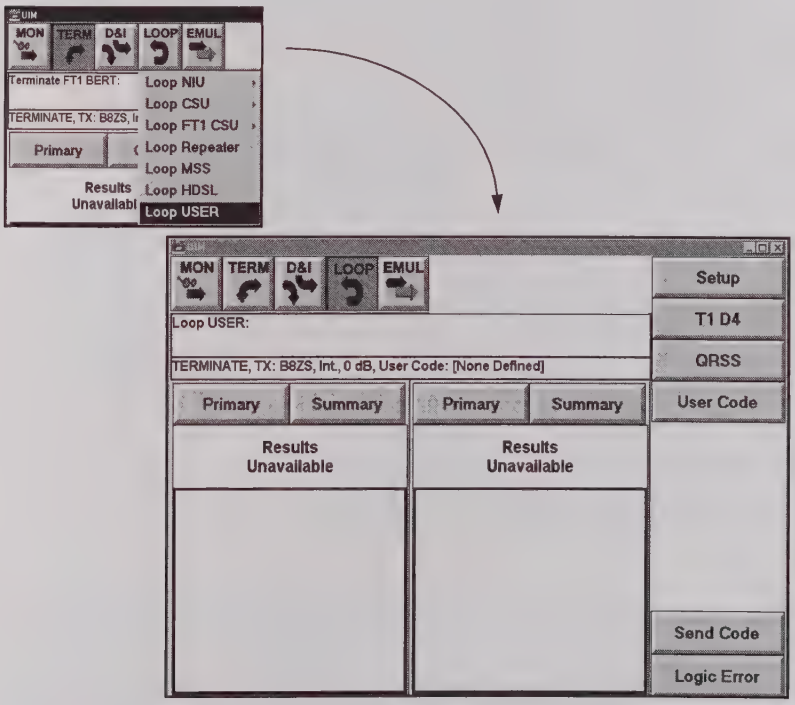
3.22 USER-PROGRAMMABLE LOOP CODES AND PATTERNS

Using the programmable codes and patterns feature, you can add up to 10 new loop codes and patterns. Codes and patterns can be named and stored in NOVRAM. Clearing NOVRAM removes codes and patterns.

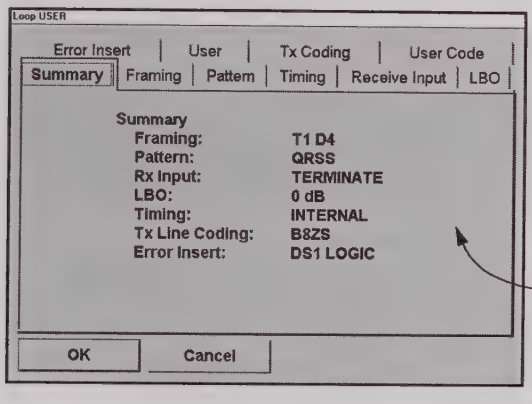
3.22.1 Programmable Code Configuration

Programmable Code Setup Procedure:

1. Select **LOOP**. Then, select **Loop User** from the pull-down menu. The 2209 automatically configures to a default setup for the chosen application.

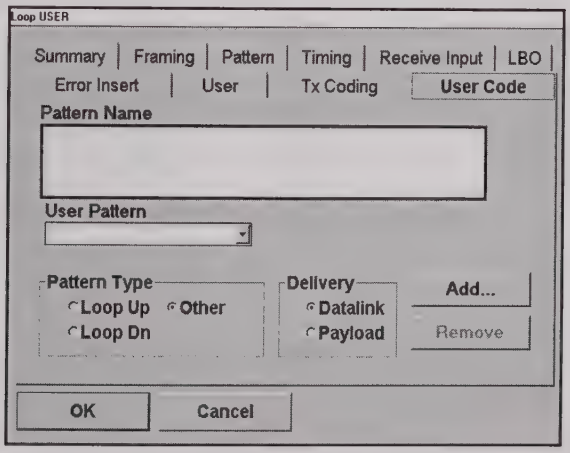


2. Press **Setup**. Ensure characteristics shown in the **Summary** setup screen match the network characteristics.



To change baseline settings in the **Summary** property sheet, select the desired tabs behind it and select specific parameters for your programmable test.

3. Select **User Code** property sheet.

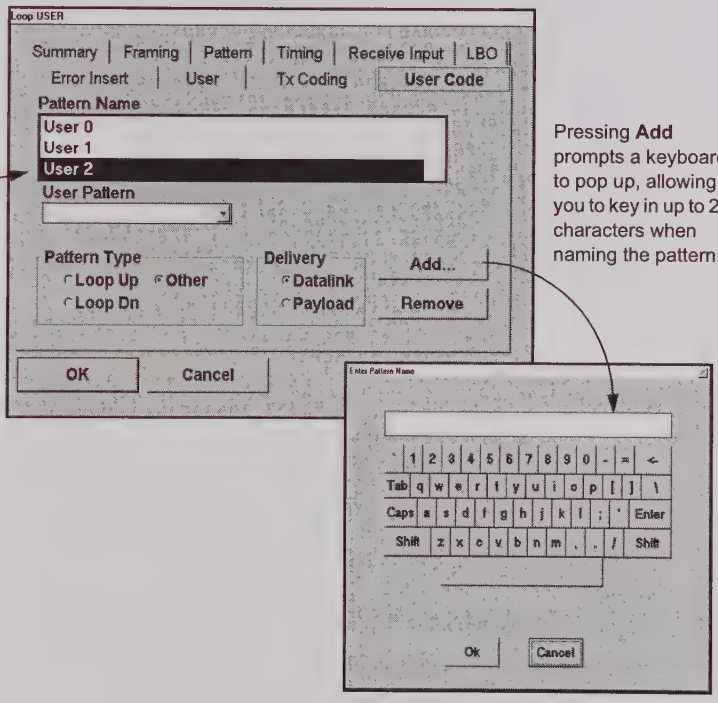


NOTE

*When either **Datalink** or **Payload** is selected, the one not selected is disabled.*

A scrolling list of up to 10 available pattern name selections appear.

Touch the screen to select a pattern name. If adding a name, press **Add**. If removing a name, highlight the name and press **Remove**.

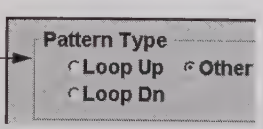


Pressing **Add** prompts a keyboard to pop up, allowing you to key in up to 25 characters when naming the pattern.

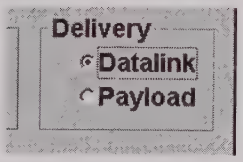
4. Select **Pattern Type**. You can choose:

   - **Loop Up** — Sends a loop up command and reports if the loop up was successful.
   - **Loop Dn** — Sends a loop down command and reports if the loop down was successful.
   - **Other** — Allows you to send a long, user pattern.

Loop Up/ Loop Dn allows the patterns to be sent on datalink or payload. **Other** only allows the pattern on the payload.



5. Select **Delivery**. You may transmit the programmed code on either the ESF data link or the payload for **Loop Up** or **Loop Dn**.

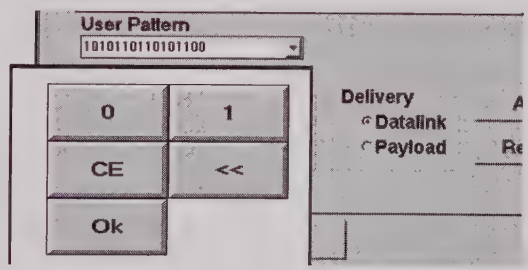


Datalink — Select and send pattern on datalink for 3 seconds.

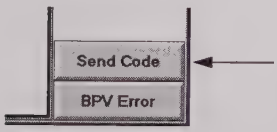
Payload — Select and send pattern on payload for 20 seconds.

6. Select **User Pattern**. Press the down arrow to select a pattern. Highlight the pattern you want to send. *If the code is either **Loop Up** or **Loop Dn**, you can enter up to a 16-bit binary pattern. If **Other** is selected, you can select up to a 20-byte, hexadecimal pattern.*

Pattens added to, removed from, or changed on the list are not saved until the **OK** button is pressed on the **User Code** property sheet (so, after pressing **OK** here, *press **OK** at bottom of property sheet).*



7. Select **Send Code** to send the selected programmable code.



Press **Send Code** for all types of patterns.

NOTE

*Once you send a programmable code, the results depend on the type of code selected. If **Loop Up** or **Loop Dn** is selected, a message is relayed to the screen indicating the success or failure of the code. If **Other** is selected, the pattern is sent indefinitely until **Stop Code** is selected.*

SECTION 4 ISDN PRI OPTION

4.1 INTRODUCTION

The ISDN Primary Rate Option allows the 2209 to test the operational status of ISDN PRI links which use T1 as the physical interface. Features and capabilities of the 2209 Primary Rate ISDN Option include:

- Provide support for LUCENT 5ESS, NT DMS 100, and National ISDN-2 Call Control specifications.
- Provide support for different call types which include voice, 56K, 64K, Nx64K, Nx56K, and H0.
- Place or receive two simultaneous voice and data calls while emulating a Terminal Equipment (TE) device (e.g., PBX).
- Test data services with BERT patterns or test voice services with a hands-free microphone and speaker.
- Provide history of calls that were placed and terminated, as well as, providing their corresponding cause codes.
- Monitor physical layer (T1), and provide decodes of LAPD and Q.931 messages sent on the D-Channel.
- Perform back-up D-Channel testing and ability to support Network Facility Associated Signaling (NFAS).

4.2 SPECIFICATIONS

Table 4-1 lists the specifications for the Primary Rate ISDN Option.

Table 4-1. ISDN Option Specifications

Item	Specification
Connectors	Option utilizes the T1 Interface connectors
Line Termination (resistive)	100 ohms ±5%
TEI Assignment	0

4.3 FUNCTIONAL APPLICATIONS

The Primary Rate ISDN Option operates in one of two operating modes: Monitor mode or Terminate mode. The following paragraphs discuss each mode in detail.

4.4 MONITOR MODE FOR ISDN PRI CALLS

In Monitor mode, the unit allows full duplex, non-intrusive monitoring of a single D-Channel (which enables interpreting messages going from Terminal Equipment (TE) to Network Termination (NT) as well as messages going from NT to TE). In addition to providing the T1 results, the option provides full text decodes of the messages on the D-Channel.

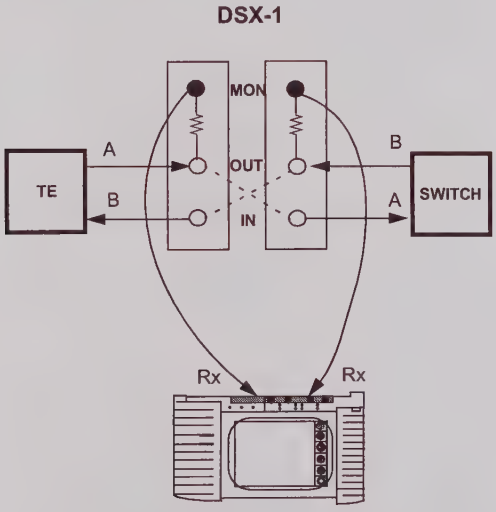


Figure 4-1. Monitor ISDN PRI Test Setup

Use the following setup procedures to prepare the 2209 to test ISDN PRI transmissions.

1. Press **MON**. Then, select **Monitor ISDN PRI** from the pulldown menu. The 2209 automatically configures to a default setup for the chosen application (see Figure 4-2).

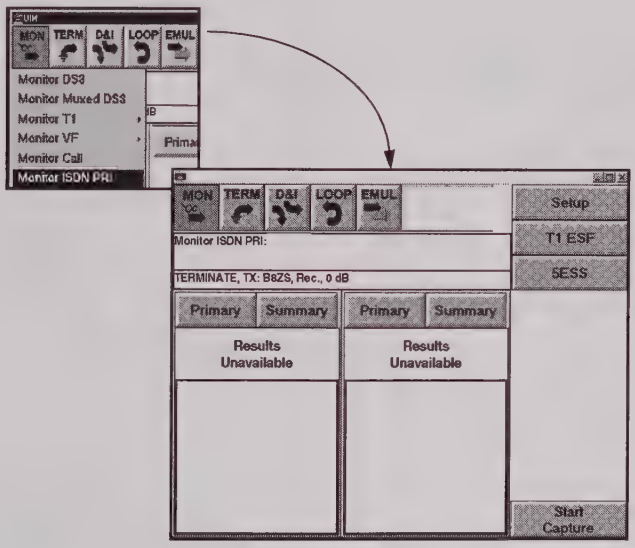
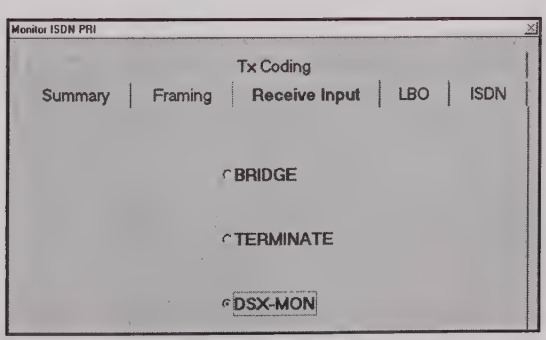
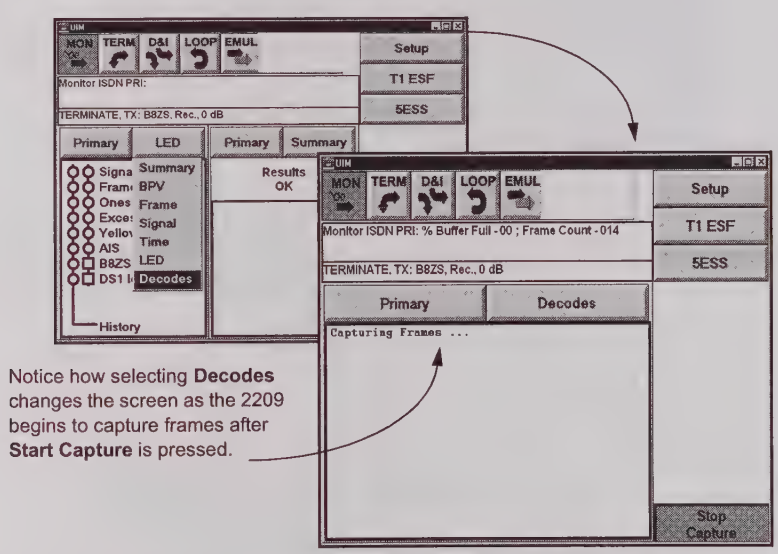


Figure 4-2. Monitor ISDN PRI Setup Screen

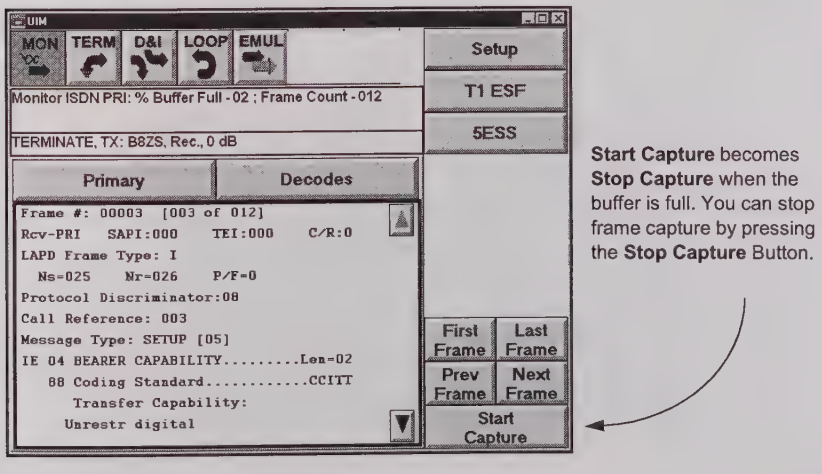
2. Press **Setup**. Ensure the characteristics shown in the setup **Summary** screen match the network characteristics. To change settings, select the desired property sheet tabs in the property setup sheet.
3. Select the **Receive Input** tab. Ensure that **BRIDGE** or **DSX-MON** is selected.



4. Select **Decodes** in Result CATEGORY under either Primary or Secondary Result GROUP.



5. View the B-Channel message decodes. The number of frames captured and the percent of buffer used displays in the status message window.



6. **Stop Capture** displays the last captured frame in the Display window. If no frames were captured, the text `no frames captured` displays. To traverse through the list of frames that were captured, press any of the four ACTION buttons named **First Frame**, **Last Frame**, **Prev Frame**, and **Next Frame**.

7. Observe results in the display.

4.5 TERMINATE MODE FOR ISDN PRI CALLS

The Terminate ISDN PRI test application emulates a TE device such as a PBX or a router. This allows you to place a call to the network or receive a call from the network. Figure 4-3 shows the Terminate application menu.

1. Press **TERM**. Then, select **Terminate ISDN PRI** from the pulldown menu. The 2209 automatically configures to a default setup for the chosen application.

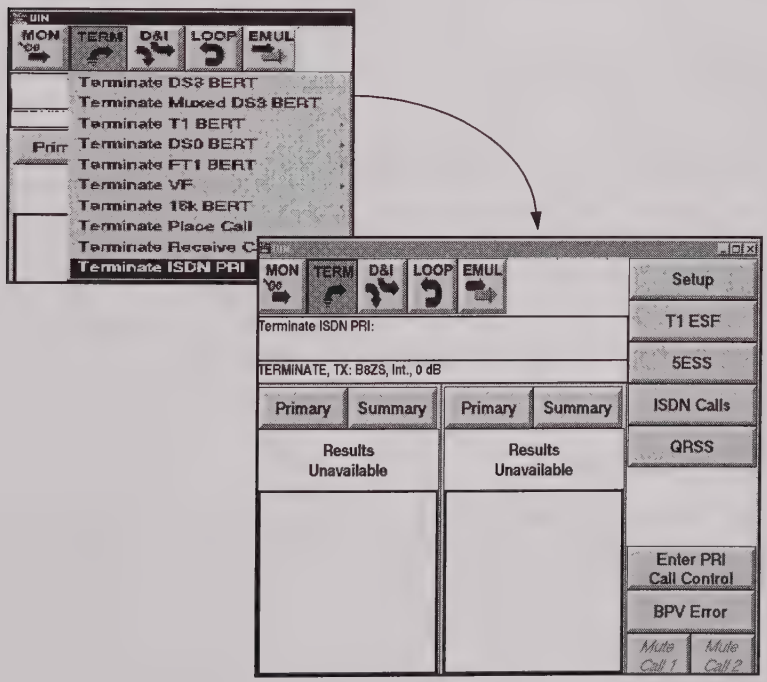
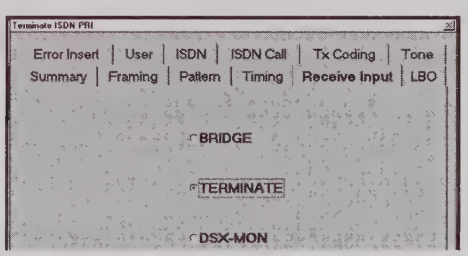


Figure 4-3. ISDN PRI Terminate Mode

2. Press **Setup**. Ensure the characteristics shown in the setup **Summary** screen match the network characteristics. To change settings, select the desired property sheet tabs in the property setup sheet.
3. Select the **Receive Input** tab. Ensure that TERMINATE is selected.



4. Select the **ISDN** Property Sheet tab. Configure **Call Control**, D-Channel test type (**Primary Only** or **NFAS/DCBU**), and the **D-Channel** (s) DS0s (see Figure 4-9).
5. Select the **ISDN Call** property sheet tab. Configure the call(s) by pressing **Config Call 1** and/or **Config Call 2** (see Figure 4-10). Refer to Table 4-3 for definitions of call configurations.
6. Press **OK**.

   When the 2209 is configured for the correct switch type (Call Control) and the D-Channel, it establishes the data link and is ready to carry out ISDN call processing. The unit enables BERT and VF analysis of the B-channels being used, after successful call establishment. In addition to providing T1 results, the unit also provides statistics collected on the D-channel, as well as results based on the analysis of the B-channel. The Call Controls supported in this mode include LUCENT 5ESS, NT DMS 100, and NI-2.

4.6 SUPPORTED FEATURES OF TERMINATE MODE PRI

4.6.1 Place Call and Receive Call

Place Call and Receive Call enables the processing of up to two simultaneous calls—two terminating, two placing, or generating one call while terminating a second call. One or two calls may be placed on the same T1 or on different T1s. The following parameters must be set up to support the application:

- Switch type: LUCENT 5ESS, NT DMS 100, or NI-2
- Call Control

- Primary D-Channel Selection

Each call configuration contains the following call settings:

- INTERFACE — Primary or Secondary
- CALL TYPE — Voice or 56K, 64K, Nx56K, Nx64K, H0
- CALLED NUMBER — Number dialed
- CALLING NUMBER — Number assigned to calling party (assigned number of unit)
- B-CHANNEL PREFERENCE — B-channel(s) specified to carry call

Table 4-2 shows the various call types supported by this option.

Table 4-2. ISDN PRI Call Specifications

Item	Specification
Voice, 56K Data, and 64K Data	One of 23 B-channels
Nx64K Data, Nx56K Data	One or more contiguous or non-contiguous B-Channels
H0	Limited to established channel groupings (1-6, 7-12, 13-18, 19-24). A given group of six channels is only available if there are no channel conflicts with other calls or with the D-Channel selection.

In case of data calls — A single pattern selection applies to both Data calls.

In case of voice calls — **Call 1** gets its input either from the unit microphone (press **Push 2 talk**) or the handset. **Call 2** gets its input from the tone generator (whose frequency can be changed through **Setup** property sheets by selecting the **Tone** property sheet. Dual mute buttons allow selective listening on each call.

To place an ISDN call from the 2209 to the network, set the call parameters (e.g., key in the digits to place the call request to the network) in the setup property sheets. Figure 4-4 shows a selection of property sheets typical for placing/receiving an ISDN PRI call.

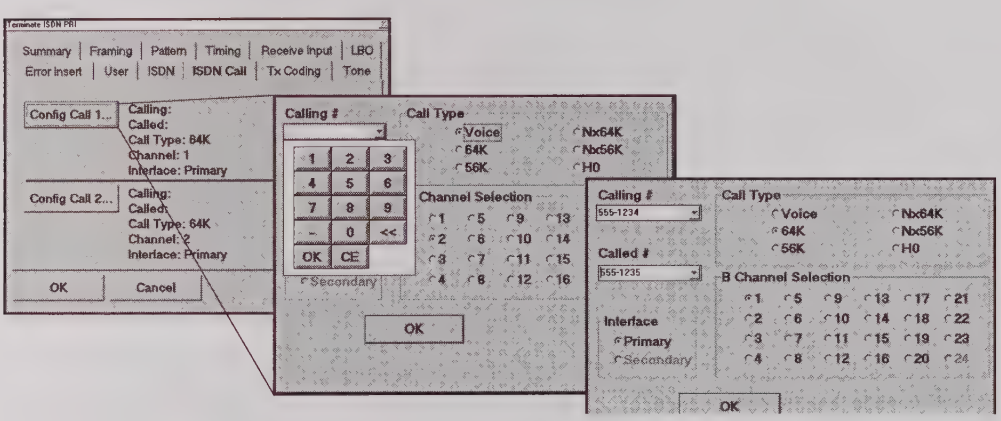


Figure 4-4. Samples of ISDN Call and Call Type Property Sheets

Table 4-3 describes the various parameters you can set for ISDN PRI.

Table 4-3. ISDN PRI Config Call 1/Call 2 Property Sheet

Item	Definition
Calling #	Call ID number of your outgoing call.
Called #	Number you are trying to call.
Interface	Valid only when testing DCBU/NFAS, and it indicates whether the interface is Primary or Secondary on the outgoing call.
Call Type	Data (64k, 56k, Nx64K, Nx56k, H0) or Voice
B-Channel Selection	Designated DS0s for the call

Once the parameters for the call are set, press the **Enter PRI Call Control** ACTION button. The **PRI Call Control** keypad pops up (Figure 4-5). Press **Conn** to place the call.

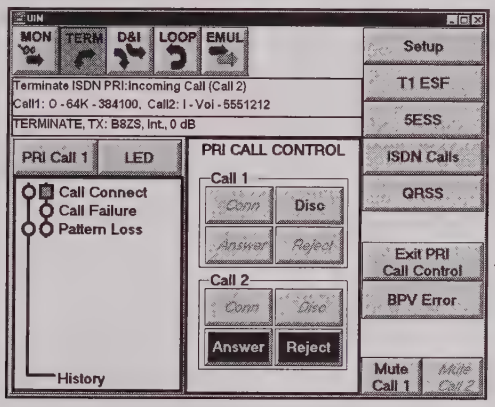


Figure 4-5. ISDN PRI Call Control Keypad

To receive an ISDN call from the network to the 2209, you are alerted by a flashing **Enter PRI Call Control** ACTION button, and a message in the status display. If the PRI Call Control Keypad is not already open, press **Enter PRI Call Control** to open it. You can press **Answer** or **Reject** for the incoming call.

4.6.2 NFAS Capability

Network Facility Associated Signaling (NFAS) supports non-facility associated signaling where the signaling information for two PRI links takes place on one D-Channel. The Interface Identifiers are set to 0 for the Primary Interface and 1 for the Secondary Interface. To change the test configuration, press **Setup** and then select the **ISDN** property sheet tab. Select the **NFAS/DCBU** radio button. Figure 4-6 shows how this selection enables the Secondary Interface.

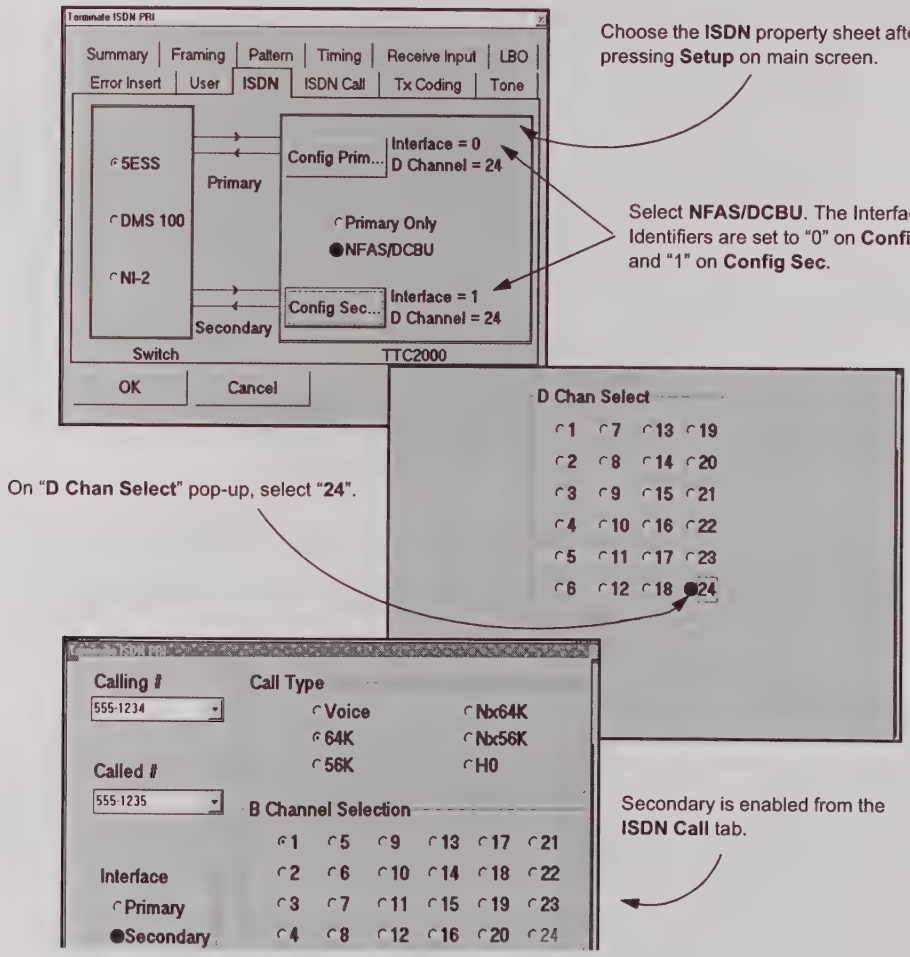


Figure 4-6. NFAS/DCBU Property Sheet Set Parameters

NOTE

The switch must have D-Channel Backup in order to utilize the NFAS Capability.

4.6.3 D-Channel Backup Testing

The D-Channel Backup option enables all signaling information to take place on one D-Channel for both PRI interfaces (NFAS). Furthermore, there is a dedicated channel on the non-active D-Channel interface for the purpose of carrying signaling information in the case of the primary D-Channel failure. To select the DCBU/NFAS mode, press **Setup**, followed by the **ISDN** Setup Tab. Select **NFAS/DCBU**. This selection enables the Secondary Interface (see Figure 4-6). In addition, the **Config Sec.** button is activated. The **Config Sec.** button allows the selection of which DS0 will carry signaling information. The D-Channel on each interface exists in one of several states. To check this information, select the Result GROUP for the desired interface, and then select **ISDN Stats** Result CATEGORY (see Figure 4-7).

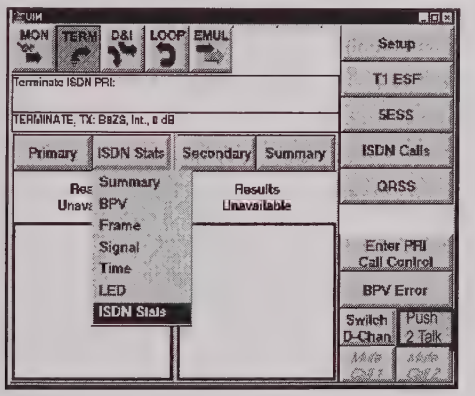
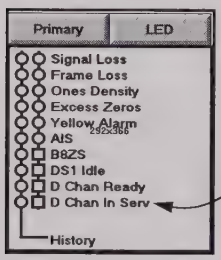
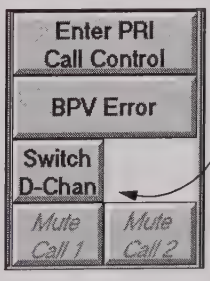


Figure 4-7. ISDN Status CATEGORY for D-Channel Test

The **Layer 2 Serv State** Result conveys which state the D-Channel is currently in. Also, a **D-Chan In Serv** LED is provided under the **LED** Result CATEGORY as a convenient means of checking for an In-Service D-Channel. To initiate the D-Channel to test the switch over of a Standby D-Channel to the In-Service D-Channel, disconnect the In-Service T1 or press the **Switch D-Chan** button.



Select **D Chan In Serv** in the **LED** CATEGORY to locate an In-Service D-Channel



The backup D-Channel feature can test the switch over of a Standby D-channel to the In-Service D-Channel. Just press **Switch D-Chan** on main screen.

Table 4-4 describes the D-Channel message displays.

Table 4-4. D-Channel States and Descriptions

D-Channel States	Descriptions
In Service	D-Channel currently carries signaling information.
Out of Service	D-Channel is not available.
Maintenance Busy	State is entered automatically, generally while state changes are taking place on the other interface.
Wait	D-Channel is waiting for a response from the network in order to enter the In-Service State.
Standby	D-Channel is now prepared to transition to the In-Service State in the case of the primary D-Channel failure.

4.7 ISDN PROPERTY SHEETS AND MENUS

4.7.1 ISDN Setup Property Screen

The ISDN setup screen is visible only when the **Monitor ISDN PRI** or **Terminate ISDN PRI** test applications are active. To check or change the ISDN PRI configuration, press the **Setup** button, which replaces the main screen with the **Summary** property sheet screen (see Figure 4-8).

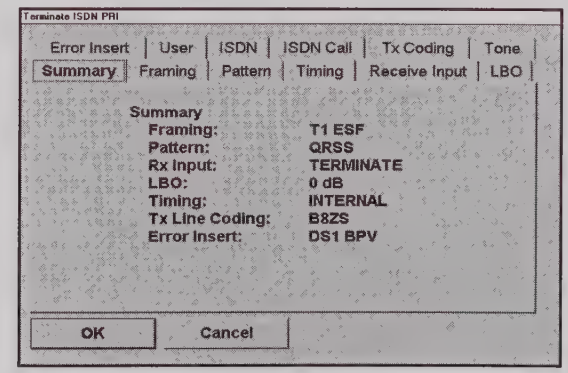


Figure 4-8. ISDN PRI Summary Screen

Select the **ISDN** tab. This property sheet enables you to select the parameters for ISDN testing.

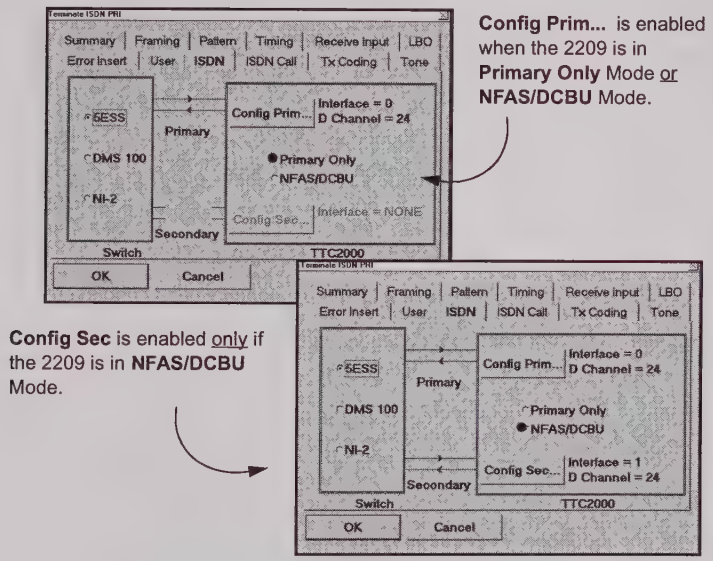


Figure 4-9. ISDN PRI Setup Screen

The **ISDN** setup screen (see Figure 4-9) shows a graphical summary of the test setup that matches the selected ISDN application. Press **Config Prim...** or **Config Sec...** to select the Primary, Secondary, and D-Channel selection. Notice that **Config Sec...** is disabled while terminating a single T1, **Primary Only** mode in the **ISDN** property sheet (when setting up for testing in Terminate ISDN PRI).

4.7.2 ISDN PRI Test Type Setup Screen Description

The Configure Primary and Secondary interface buttons set the parameters for the physical T1 interfaces of the 2209. When either interface button is pressed, a pop-up dialog box appears, which allows you to select D-Channel selection for that interface.

Switch — Sets up termination on ISDN PRI line. Choices include:

5ESS — Selects the LUCENT 5ESS as the Call Control specification. (Also the default setting.)
DMS100 — Selects the NT DMS 100 as the Call Control specification.
NI-2 — Selects the National ISDN-2 as the Call Control specification.

Config Prim... — Sets parameter for T1 Primary interfaces.

Config Sec... — Sets parameter for T1 Secondary interfaces.

D Chan Select — (Pop-up box after pressing **Config Prim...**or **Config Sec...**) Selects the DS0 channel on which the D-Channel signaling information is to be transmitted.

4.8 ISDN PRI CALL SETTINGS MENU

The ISDN PRI Call property sheet (**ISDN Call**) is visible only when the Terminate ISDN PRI mode application is active. Parameters must be set for both **Call 1** and **Call 2** when connecting to two calls simultaneously. Press **Config Call 1** (or **Config Call 2**) for a pop-up dialog box to change the parameters (Figure 4-10).

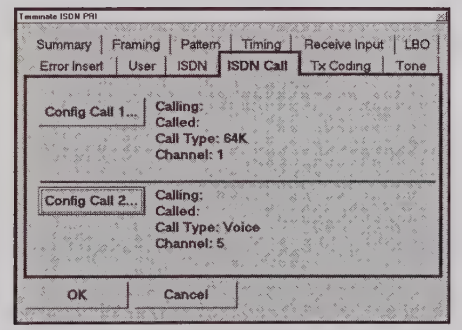


Figure 4-10. ISDN PRI Call Settings

4.8.1 ISDN PRI Call Type Screen Description

Pressing **Config Call 1** from the **ISDN Call** property sheet displays the following dialog box (Figure 4-11). The following parameter choices are available:

- **Call Type** selects the type of call to be generated and also determines the type of analysis

performed on the B Channel for outgoing calls. (Default value is **VOICE**). For incoming calls, the call type is determined by the request message from the network. The choices are:

VOICE — Selects a voice type call.

64K — Selects a clear channel, unrestricted, circuit switched data connection with the full 64 kbps available for use, with no rate adaptation.

56K — Selects an unrestricted circuit switched data connection with 56 kbps CCITT I.463 rate adaptation.

Nx64K — Selects contiguous/noncontiguous 64 kbit/s timeslot operation.

Nx56K — Selects contiguous/noncontiguous 56 kbit/s timeslot operation.

H0 — Selects an **H0** type data call.

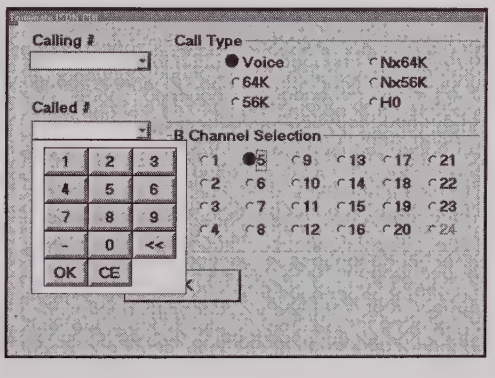


Figure 4-11. ISDN PRI Call Setting Pop-up Dialog Box

- **B-Channel Selection** enables you to select the B channel on which the ISDN Call is to be placed. Any number (except the D-channel) between 1 and 24 may be entered.
- **Interface Selection** (not shown) enables you to select either the Primary or Secondary T1 interface.
- **Calling Number** enables entry of the caller number (directory number), up to 15 digits. A pop-up Dial pad is used to edit this field. Valid keys are **0** through **9**, the minus sign (**-**), the (OK) key, and the (CE) clear key.
- **Called Number** enables entry of the number that has been called. The Edit Control pop-up keypad is used to edit this field when the down arrow key is pressed.

NOTE

The B-Channel number selection changes with the Call Type. For example, "Voice" selection is a radio button, but "Nx56k and Nx64k" is a checkbox selection. Therefore, the Call Type dynamically alters the B-Channel number selection.

4.9 PLACING AN ISDN PRI CALL TO TPI 560P

1. Press **Enter PRI Call Control** ACTION button (see Figure 4-5).
2. Press **Conn** to engage outgoing call. Setup information displays in the status window. (**Conn** button remains depressed until the TPI 560P answers the call.)
3. TPI 560P answers the call and announces the type of service, calling number, and prompts you, `hang up for call back`. The **Conn** button becomes disabled, and the **Disc** (Disconnect) button enables, leaving you with an active call (see Figure 4-5). *The audible voice announcement is only available for single, B-Channel calls.*
4. Press **Disc**. The call disconnects, leaving **Conn** enabled again. TPI 560P returns the call, if connected. If the Call Control window is visible, the **Answer/Reject** buttons flash when the call is received. Otherwise, **ENTER PRI Call Control** blinks, prompting you to press it.
5. Press **Answer** or **Reject**. This action prompts the **Disc** button to enable.
6. Establish the loopback. Now BER testing can qualify the line. The 2209 automatically inserts the configured pattern on the B-channels of the incoming or outgoing call(s).
7. Press **Disc** to disconnect the call.

4.10 ISDN PRI TEST RESULTS

Test results for the Primary Rate ISDN Option are displayed in the Terminate mode. There are two types of ISDN results:

- Physical Interface (T1)-Relative
- Call-Relative

The left button on the Results GROUP window controls access to these two different types of results. This button has a drop-box menu with **Primary/Secondary/Call 1/Call 2** selections. Figure 4-12 shows a description of typical Primary Rate ISDN results screens.

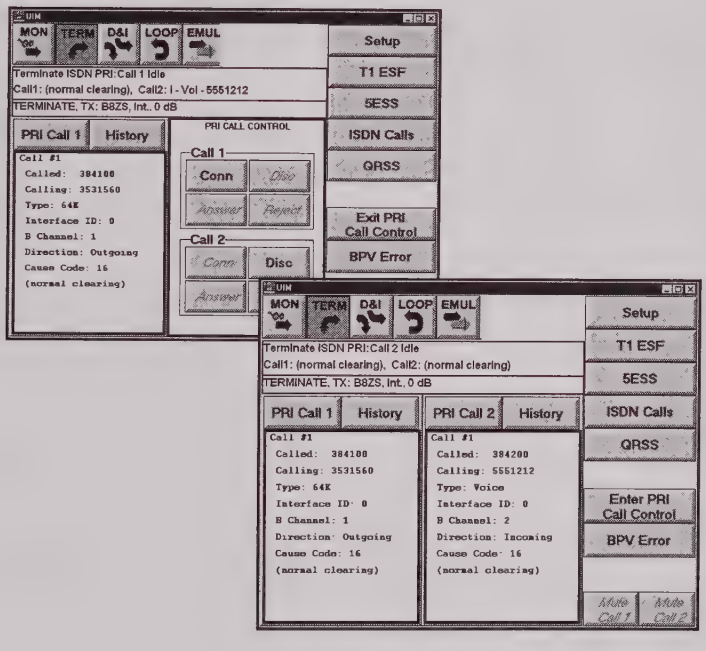


Figure 4-12. ISDN PRI Result Screens

Primary/Secondary selects the physical interface on the ISDN line. This selection allows the T1 Results CATEGORIES to be displayed (either Primary or Secondary). Additionally, the frame statistics and LAPD statistics for a D-channel, which is interface-specific, is present under the Primary/Secondary Result GROUPS.

Call 1 or **Call 2** Results GROUP provide call-specific results. The Results CATEGORIES include: Summary, Logic, LED, History, and Time.

Table 4-5 lists the ISDN PRI Option test results categories.

Table 4-5. Test Results Categories for ISDN PRI

Category	Description
Summary Category (Primary/Secondary Result Group)	**LAPD Multi-Frame Loss**
	Call Fail Count
	LAPD Protocol Errors
LED Category	**D-Channel Ready** — Square LED means datalink is established and ready for call control (Pri/Sec).
	Call Connected — Square LED means call connected for **Call 1** or **Call 2**.
	Call Failure — Round LED means **Call 1** or **Call 2** has been cleared with a cause other then "normal". Check Call History.
ISDN Statistics Layer 2 Category (Primary/Secondary)	**Frame Count** — Counts the total number of valid LAPD frames received.
	Errored Frames — Valid frames with one or more of the following errored conditions: undefined control fields, "S" or "U" frame with incorrect length, or "I" frame with a long information field.
	Invalid Frames — Counts the frames with FCS errors or invalid SAPI.
	Aborted Frames — Counts the aborted LAPD frames detected (excluding Out-of-Frame aborts).
	Reject Frames — Counts the LAPD reject frames.
	Frame Reject Frames — Counts LAPD frame reject frames.
History Category (Call 1 and Call 2)	**Call Failure** — Stores up to 12 call attempts (including normal and abnormal call clears).

4.10.1 ISDN PRI Status Messages

The Status Message Display window (below the Application Selection buttons) shows the status of the D-channel and the progress of ISDN calls for both incoming and outgoing calls. Table 4-6 provides the list of messages and their descriptions. The second line of the status message window also provides additional information about call direction as follows:

Table 4-6. ISDN PRI Status Messages

Message	Description
I	Incoming
O	Outgoing
Call Type	64k, 56k, Voice, Nx64k, Nx56k, H0

Table 4-6. ISDN PRI Status Messages (Continued)

Message	Description
Called Num	Outgoing calls
Calling Num	Incoming Calls

4.10.2 ISDN PRI Cause Codes

Table 4-7 provides the information between the Cause Code and the Cause Messages that are displayed in the Message/Status window. The Cause message is shown when the Call placed between the PBX and the Network fails.

Table 4-7. Cause Codes

Cause Code #	Cause Message — Q.931 Cause Codes (1988)
1	Unassigned number
2	No route to specified transit network
3	No route to destination
6	Channel unacceptable
7	Call awarded and delivered in an established channel
16	Normal call clearing
17	User busy
18	No user responding
19	No answer from user (user alerted)
21	Call rejected
22	Number changed
26	Non-selected user clearing
27	Destination out of order
28	Invalid number format
29	Facility rejected
30	Response to STATUS INQUIRY
31	Normal, unspecified
34	No circuit/channel available
41	Temporary failure

Table 4-7. Cause Codes (Continued)

Cause Code #	Cause Message — Q.931 Cause Codes (1988)
42	Switching equipment congestion
43	Access information discarded
44	Requested circuit/channel not available
47	Resources unavailable, unspecified
50	Requested facility not subscribed
57	Bearer capability not presently authorized
58	Bearer capability not available
63	Service or option not available, unspecified
65	Bearer capability not implemented
69	Requested facility not implemented
79	Service or option not implemented, unspecified
81	Invalid call reference value
88	Incompatible destination
96	Mandatory information element is missing
97	Message type non-existent or not implemented
99	Information element non-existent or not implemented
100	Invalid information element contents
101	Message not compatible with call state
102	Recovery on timer expiry
111	Protocol error, unspecified
127	Internetworking

Table 4-8 indicates National-specific cause values.

Table 4-8. National-Specific Cause Codes

Cause Code #	Cause Message — (Defined in TA-NWT-001268)
4	Vacant code
8	Prefix 0 dialed in error

Table 4-8. National-Specific Cause Codes (Continued)

Cause Code #	Cause Message — (Defined in TA-NWT-001268)
9	Prefix 1 dialed in error
10	Prefix 1 not dialed
11	Excessive digits received; call proceeds

SECTION 5 PRINTER OPERATION

5.1 INTRODUCTION

The 2209 provides print capability for both test configuration (Controls Print) and test results (Results Print). This section describes each of the printouts and how to generate them using the Printer connector.

The 2209 can generate a printout manually or automatically (via timed prints). When a results printout is initiated either manually or automatically, the test results are dumped to the printer or stored in nonvolatile memory (if the printer is not connected to the unit).

5.2 PRINTER SETUP

The following connections and controls are used to set up the printer and 2209.

5.2.1 Printer Connection

The Printer connector on the top of the mainframe is an 8-pin connector used to connect the 2209 to a serial printer like the Acterna PR-40A/B. The connector is configured as a Data Communications Equipment (DCE) connection, which allows you to connect the 2209 to Data Terminal Equipment (DTE).

5.2.2 Printer Access Control

The 2209 printout generation is controlled through the Printer Screen see Figure 5-1, which is activated by pressing the **Printer** Permanent Softkey on the right side of the Main Display.

5.3 PRINTER PROPERTY SHEET

The following paragraphs describe the three Printer Property Sheet tabs available from which you can choose printer functions. They include:

- Print Request Tab
- Printer Settings Tab
- Print Options Tab

5.3.1 Print Request Tab

There are a series of buttons on the **Print Request** Tab see Figure 5-1 which are described in the following paragraphs.

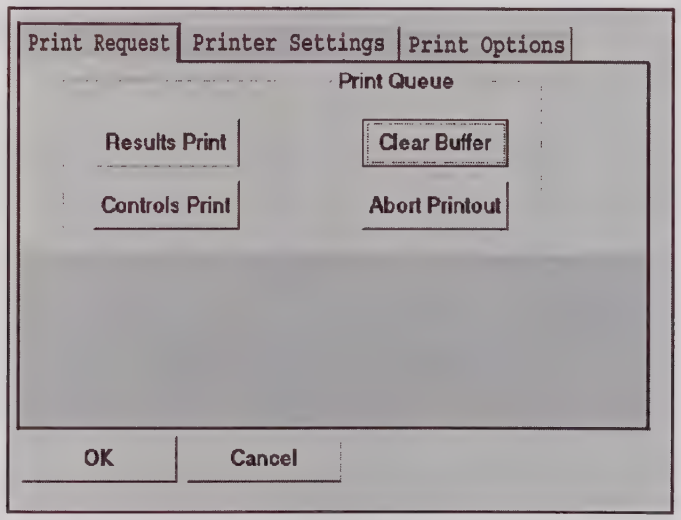


Figure 5-1. Print Request Property Sheet Tab

5.3.1.1 Results Print

Results Print generates a date-and-time-stamped printout of current test results. Test results become available only after the 2209 has received a valid signal.

NOTE

If the unit is optioned with the TestMATE Option, then the results of the automated T1 turnup test is also printed.

5.3.1.2 Controls Print

Controls Print generates a date-and-time-stamped printout of the current test configuration. This printout includes the test application and parameters associated with the test setup.

5.3.1.3 Clear Buffer

Clear Buffer clears all printouts from the print buffer. The print buffer stores up to 10 Results and Controls Printouts until the 2209 can be connected to a printer. If the print buffer is full and a printer is not connected or is off line, the first and the most recent printouts are retained while any new printouts overwrite the ones stored in the middle of the print buffer queue.

5.3.1.4 Abort Printout

Abort Printout cancels the most recent printout if the printer is connected, and it has not completed the printout.

5.3.2 Printer Settings Tab

Selecting the **Printer Settings** tab see Figure 5-2 allows you to select the baud rate and parity for the printer interface.

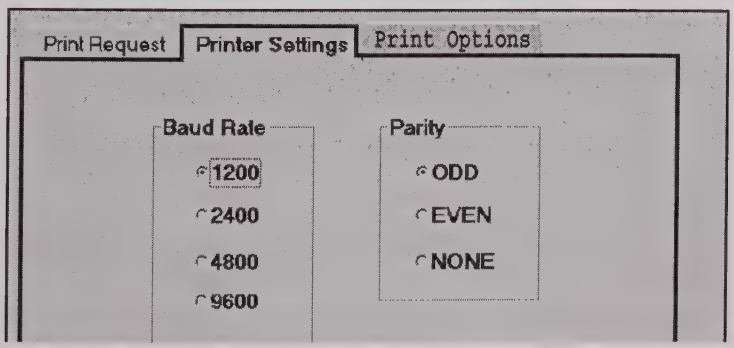


Figure 5-2. Printer Settings Property Sheet Tab

5.3.3 Print Options Tab

From the Print Options tab see Figure 5-3, the 2209 has the ability to create **Timed Prints**, complete with a results printout generated. Choose from any of the listed options.

If you choose **Disabled**, printouts are performed manually every time you press **Results Print**. The other radio buttons specify when results are printed. Choices include results being printed every 15 minutes, every 2 hours, or every 24 hours.

If you choose **Test End,** the 2209 is able to create a timed test with a results printout generated at the end of whatever timed interval you select from a duration of (maximum) 200 hours, 59 minutes, and 59 seconds.

If you choose **Print on Error,** results are printed with a time/date stamp when any summary event occurs. These include logic errors, CRC errors, frame Errors, BPVs, or changes in alarm conditions.

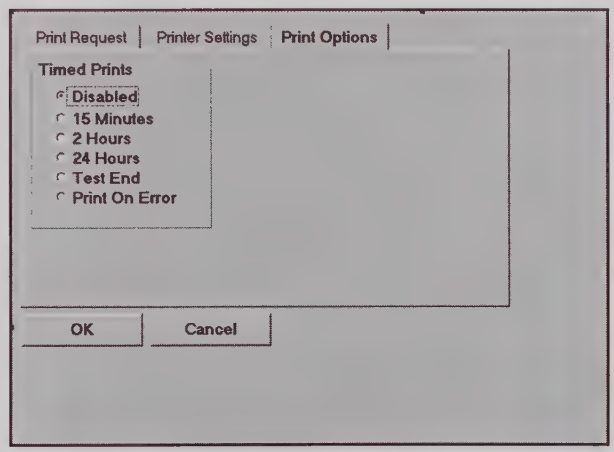


Figure 5-3. Print Options Property Sheet Tab

SECTION 6 SPECIFICATIONS

6.1 GENERAL SPECIFICATIONS

6.1.1 Physical Characteristics:

Height:	7.5" (19 cm)
Width:	11.5" (29.2 cm)
Depth:	2.25" (5.7 cm)
Weight:	4.25 lb. (1.93 kg)

6.1.2 Environmental Characteristics:

Temperature:	
Operating:	32°F to 122°F (0°C to +50°C)
Non-Operating:	-40°F to 167°F (-40°C to +75°C)
Humidity:	10% to 90% Relative Humidity, non-condensing

6.1.3 Electrical Characteristics:

Battery Type:	10.8 V Nickel-Metal Hydride (NiMH)
Operating Time:	Typically, up to three hours of continuous operation on a full charge
Recharging Period:	Maximum of two hours from full discharge
AC Adaptor:	120VAC to 18 VDC 1.2A

6.2 DS1 SPECIFICATIONS

6.2.1 Input Specifications

6.2.1.1 RX Jack

Connector Type:	Bantam jack
Frequency:	1,544,000 Hz ±5000 Hz

Impedance

Bridge:	1000 ohms minimum
Term:	100 ohms ±5%
DSX-MON:	100 ohms ±5%

Range

Bridge:	+6 to -35.0 dBdsx
Term:	+6 to -35.0 dBdsx
DSX-MON:	+6 to -24.0 dBdsx of resistive loss

6.2.1.2 Loop Codes Detection Criteria

In-Band:	At least 177 error-free bits of the selected repetitive pattern must be received (loop up or loop down).
Out-of-Band:	Datalink monitored every 125 ms for loop codes (loop up and loop down).

6.2.1.3 Pattern Synchronization Detection Criteria

Fixed Patterns:	30 consecutive error-free bits
QRSS:	30 + n consecutive error-free bits for a pattern length of 2^n-1

6.2.2 Output Specifications

6.2.2.1 TX Jack

Connector Type:	Bantam jack
LBO Level:	Line build-out of 0, -7.5, -15.0, and -22.5 dB of cable loss at 772 Hz
LBO Tolerance:	±1 dB at 772 kHz
Timing:	±7 ppm internal or recovered
Line Codes:	AMI or B8ZS
Error Insert Type:	Logic, BPV, or Frame
Pulse Shape:	With output terminated in 100 ohms resistive load and 0 dB line build-out selected, the 2209 meets ITU-T Recommendation G.703; AT&T Publications CB113, CB119, CB132, CB143, and PUB62508; and AT&T PUB62411 pulse shape specifications.

6.2.2.2 *Transmitted Loop Codes*

In-Band

CSU:	Loop-up: 10000; Loop-down: 100
Facility 1:	Loop-up: 1100; Loop-down: 1110
Facility 2:	Loop-up: 11000; Loop-down: 11100
Facility 3:	Loop-up:100000; Loop-down:100 (N.E.Tel.)

Out-of-Band

Line:	Loop up: 1111 1111 0111 0000 Loop down: 1111 1111 0001 1100
Payload:	Loop up: 1111 1111 0010 1000 Loop down: 1111 1111 0100 1100
Network:	Loop up: 1111 1111 0100 1000 Loop down: 1111 1111 0010 0100

6.2.3 Measurements Specifications

Frequency

Range:	1,544,000 ±5000 Hz
Accuracy:	± 7 ppm
Resolution:	1 Hz

Received Level

Range:	+6 dBdsx to -40 dBdsx
Accuracy:	±1.0 dB between +6 and -10 dBdsx ±2.0 dB between -10 and -20 dBdsx ±3.0 dB between -20 and -40 dBdsx
Resolution:	0.1 dB
Vp-p Range:	60 mV to 12.0 V
Vp-p Resolution:	0.05 V

Simplex Current

Range:	10 mA to 180 mA
Accuracy:	±5%
Resolution:	1 mA
Simplex path:	13.2 ohms (nominal)

6.2.4 Alarm Criteria

Signal Loss:	175 ±75 consecutive zeros
Frame Loss	
D4:	2 out of 5 Ft bits in error
ESF:	2 out of 5 frame bits in error
SLC-96:	2 out of 5 Ft bits in error
Pattern Loss	100 errors detected in 1000 or fewer bits
Ones Density	
QRSS:	Alarm is suppressed.
Other Patterns:	Received data contains less than n ones in 8(n+1) bits, where n=1 to 23.
Excess Zeros	
AMI:	16 or more consecutive zeros
B8ZS:	8 or more consecutive zeros
Yellow Alarm	
D4:	Bit 2 is a 0 for 255 consecutive channels.
ESF:	256 bits ±16 bits of a repetitive (1111 1111 0000 0000) pattern received in the 4 kb/s datalink.
SLC-96:	Bit 2 is a 0 for 255 consecutive channels.
AIS:	Unframed T1 signal has 2048 consecutive ones.
Low Battery:	Battery has less than 25% energy remaining.

6.3 DS3 OPTION SPECIFICATIONS

6.3.1 DS3 Specifications

6.3.1.1 Framing Formats

- Auto
- Unframed
- M13
- Muxed M13
- C-bit
- Muxed C-bit

6.3.1.2 Patterns

- 1111
- 1100 (Idle)
- 1010 (AIS)
- 1010
- 2^{15}-1
- 2^{20}-1
- 2^{23}-1
- User (3 to 24 bit programmable)

6.3.1.3 Line Coding

- B3ZS

6.3.1.4 Connectors

- WECO 560A jack

6.3.1.5 Receiver (Single)

Frequency:	44,736 Mb/s ±300ppm
Level:	HIGH: Accepts Nominal 1.2 Vp, 0 ft. of cable from High source
	DSX: Accepts Nominal 0.6 Vp, 450 ft. of cable from High source or monitor
	LOW: Accepts Nominal 0.3 Vp, 900 ft. of cable from High source

6.3.1.6 Transmitter (Single)

Frequency:	44,736 Mb/s ±20ppm
Pulse:	HIGH: Nominal 1.2 Vp (Signal meets ANSI specification T1.102-1993 and ITU-TG.703 when subjected to 450 feet of cable loss.)

DSX: Nominal 0.91 Vp (Signal meets ANSI specification T1.102-1993 and ITU-TG.703.)

LOW: Nominal 0.31 Vp

Timing: Internal Clock

Recovered Clock

6.3.2 DS3 Measurements

6.3.2.1 Summary

- Bit Errors
- Bipolar Violations
- Parity Errors
- C-bit Errors
- FEBE
- Frame Errors
- Receive Frequency
- FEAC Messages
- DS2 Frame Errors
- Pattern Slips

6.3.2.2 Logic

- Bit Errors
- Bit Error Rate
- Bit Errored Seconds
- Pattern Losses
- Pattern Slips
- Pattern Loss Seconds
- Error Free Seconds
- % Error Free Seconds

6.3.2.3 Bipolar Violations

- BPV
- BPV Rate
- BPV Errored Seconds

6.3.2.4 Frame Errors

- Frame Error Rate
- Frame Error Seconds
- Out of Frame Seconds
- C-bit Errors
- C-bit Error Rate
- FEBE
- FEBE Rate
- DS2 Frame Errors
- DS2 Frame Error Rate
- Received X-bit
- Transmit X-bit
- Frame Loss Count

6.3.2.5 Parity

- Parity Errors
- Parity Error Rate
- Parity Error Seconds

6.3.2.6 Signal

- Signal Loss
- Signal Loss Seconds
- Receive Frequency
- Receive Signal Level
- Transmit Frequency

SECTION 7 ACTERNA CUSTOMER SERVICES

7.1 INTRODUCTION

Acterna offers unmatched services to support purchased equipment, including a wide range of customer care, technical support, instrument maintenance, and training services. Acterna customer service specialists are fully trained to help customers find the answers they are looking for. Call Customer Services for:

- Information on products and services, including upgrades, calibration, training, software enhancement agreements (SEAs), and product maintenance agreements. Our representatives can also provide assistance with product returns and repairs.
- Expert technical support, including help with product configuration, circuit qualification, and complete network trouble sectionalization. Acterna is also available on a contractual basis to provide customized application development, network consulting and management services, software customization, and test procedure development.

All Acterna products are backed by an industry-leading warranty that guarantees mainframe repair or replacement for 3 years and all other parts for 1 year.

7.2 CUSTOMER SERVICE LOCATIONS

For questions regarding Acterna products and services, including return authorizations and repairs, technical support, training, and all other available services, contact your local distributor or Acterna Customer Service at one of the locations listed in the Acterna Worldwide Contact list at the beginning of the manual.

7.3 SERVICES

7.3.1 Instrument Service

To maintain your organization's long-term investment, Acterna will structure a service plan to fit your network performance goals and budget. Acterna understands the impact of equipment down time on operations and is staffed to ensure a quick turnaround. Available services include:

Product Repair — All equipment returned for service is tested to the same rigorous standards as newly manufactured equipment. This ensures products meet all published specifications, including any applicable product updates.

Calibration — Acterna's calibration methods are ISO 9001 approved and based on NIST standards. Each calibration comes with a dated certificate, instrument stickers, and a data sheet.

Factory Upgrades — Any unit returned for a hardware feature enhancement will also receive applicable product updates and will be thoroughly tested, ensuring peak performance of the complete feature set.

Software Enhancement Agreements — These agreements assist in keeping equipment up to date with the latest software features, by providing automatic notification of any new software enhancements and changes for Acterna products.

Product Maintenance Agreements — Yearly service and calibration maintenance agreements simplify billing and help ensure the equipment is always operating at optimum levels. Product maintenance agreements can be used to extend a current warranty or provide protection for out-of-warranty units.

Other Pricing Options — For out-of-warranty repairs, Acterna offers two additional pricing options: time and material pricing and flat rate pricing. Under time and material pricing, customers are billed for the actual cost of the repair, making this a cost-effective method for minor repairs. Under flat rate pricing, customers pay a fixed service charge to repair unit failures (excluding damage or abuse), resulting in simplified paperwork and easier budgeting.

7.3.2 Product Enhancement Group

The Product Enhancement Group staff offers one of the broadest and most experienced resource portfolios in the communications testing industry. This team of professionals offers expertise in software development, test procedure development, and network consulting, as well as years of expert test knowledge. Support is available for all core Acterna product lines:

Network Consulting and Management — Provides services such as productivity analysis, test strategy assessment, on-site applications assistance, and specialized training.

Software Customization — Develops scripts for remote and automated testing, statistics, and emulation.

Test Procedure Development — Creates procedures for automated testing, network testing, and compliance testing.

7.3.3 Test Systems Field Engineering and Installation

Acterna offers a range of support services for our centralized test systems, designed around the needs of the customer's network. These services help preserve the investment over the life of the equipment. Available services include:

Critical Services Program — Provides technical support at any time, 7 days a week, 24 hours a day. Replacement parts are guaranteed to arrive within 48 hours of contacting Acterna.

Maintenance Contracts — Cost-effective management for networks with multiple test systems.

Out-of-Warranty Service Agreement — Covers the test system for failures after the warranty expires, including all time and material costs and return shipping costs to the customer site.

Field Engineering and Installation Service — Provides a variety of options for implementing the test system into the network, including installation, configuration, upgrades, and on-site technical support.

7.3.4 Technical Training

By providing both experienced instructors and a hands-on atmosphere, Acterna training is designed to optimize test strategies and employee development requirements. Available services include:

Customized Technical Training — Designed to incorporate real-life challenges technicians face daily, while addressing the customer's training requirements, Acterna provides training at the customer's designated site, so the whole staff is trained at one time. Step-by-step reviews of current technologies and products enable new or experienced technicians to translate theory into practical, hands-on expertise.

Public Courses — Regularly scheduled, in-depth, hands-on product and technology courses are offered worldwide. Public courses provide a learning environment that allows individuals from different companies to share their knowledge and experience with their peers.

Computer-Based Training (CBT) — Acterna's CBT complements our hands-on technical training. With CBT, customers can learn about emerging communications technologies at their own convenience — at work, at home, or while traveling. Acterna's CBT courses cover technology topics such as ATM, frame relay, ISDN, LAN basics, and more.

Customized Multimedia Course Development — Multimedia courseware can be created to customer specifications, making it easier to learn new test instruments or applications. These custom packages provide consistent educational content and training for the entire staff. Students learn at their own pace on their own PC.

Consulting and Needs Analysis Services — Acterna can help identify training needs and develop customized training curricula to maximize learning opportunities, all while providing a measurable return on investment.

7.4 WARRANTY INFORMATION

The warranties described herein shall apply to all commercially available Acterna products. Any additional or different warranties shall apply only if agreed to by Acterna in writing. These warranties are not transferable without the express written consent of Acterna.

7.4.1 Hardware Warranty

Acterna warrants that Hardware Product sold to customer shall, under normal use and service, be free from defects in materials and workmanship. The warranty period shall be three (3) years for mainframes and options (parts and labor), and (1) one year for accessories and field-replaceable batteries. If installation services have been ordered, the warranty period shall begin on the earlier of (1) completion of installation, or (2) thirty (30) days after shipment to Customer. If Installation Services have not been ordered, the warranty period shall begin upon shipment to Customer. Hereafter these periods of time shall be collectively referred to as the "Initial Warranty Period".

Acterna's obligation and customer's sole remedy under this Hardware Warranty is limited to the repair or replacement, at Acterna's option, of the defective product. Acterna shall have no obligation to remedy any such defect if it can be shown: (a) that the Product was altered, repaired, or reworked by any party other than Acterna without Acterna's written consent; (b) that such defects were the result of customer's improper storage, mishandling, abuse, or misuse of Product; (c) that such defects were the result of customer's use of Product in conjunction with equipment electronically or mechanically incompatible or of an inferior quality; or (d) that the defect was the result of damage by fire, explosion, power failure, or any act of nature.

Acterna warrants that Products returned to Acterna for repair shall be warranted from defective materials and workmanship for one (1) year for the same repair issue, and ninety (90) days for a different repair issue from date of shipment from Acterna to customer, or until the end of the Initial Warranty Period, whichever is longer. Risk of loss or damage to Product returned to Acterna for repair or replacement shall be borne by customer until delivery to Acterna. Upon delivery of such product, Acterna shall assume the risk of loss or damage until that time that the product being repaired or replaced is returned and delivered to customer. Customer shall pay all transportation costs for equipment or software shipped to Acterna for repair or replacement. Acterna shall pay all transportation costs associated with returning repaired or replaced product to customer.

7.4.2 Software Warranty

Acterna warrants that Software Products licensed to Customer shall, under normal use and service, and for a period of ninety (90) days from the date of shipment of the Software to Licensee (the "Warranty Period"), perform in all material respects in accordance with the published specifications for

such Software as established by Acterna. However, Acterna does not warrant that the Software will operate uninterrupted or error free, operate in the combination with other software, meet Customer's requirements, or that its use will be uninterrupted.

Acterna's obligation and Customer's sole and exclusive remedy under this Software Warranty is limited to, at Acterna's option, either (i) correcting the material errors reported to Acterna in writing by Customer during the Warranty Period and which Acterna is able to reproduce, (ii) replacing such defective Software, provided that Acterna received written notice of such defect within the Warranty Period, or (iii) provided that Acterna received written notice of such defect within the Warranty Period, terminating the License and, upon return to Acterna of the Software, Documentation and all other materials provided by Acterna under the applicable License, providing Customer with a refund of all charges paid with respect thereto. Acterna shall have no warranty obligations hereunder if (a) the Software is altered or modified or is merged with other software by Customer or any third party or (b) all or any part of the Software is installed on any computer equipment other than the Designated Server or used with any operating system for which the Software is not designed.

7.4.3 Services Warranty

Acterna warrants that the Services provided by Acterna, if any, shall be performed promptly, diligently and in a professional manner in accordance with the commercial standards of the industry. Acterna shall not, however, be responsible for any delays that are not due to Acterna's fault or negligence or that could not have reasonably been foreseen or provided against.

7.4.4 WARRANTY DISCLAIMER

FOR HARDWARE, SOFTWARE, AND/OR SERVICES FURNISHED BY ACTERNA, THE FOREGOING WARRANTEES ARE IN LIEU OF ALL OTHER WARRANTEES AND CONDITIONS, EXPRESS OR IMPLIED. ACTERNA SPECIFICALLY DISCLAIMS ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, ON ANY HARDWARE, SOFTWARE, DOCUMENTATION OR SERVICES INCLUDING BUT NOT LIMITED TO WARRANTIES RELATING TO QUALITY, PERFORMANCE, NONINFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AS WELL AS THOSE ARISING FROM ANY COURSE OF DEALING, USAGE OR TRADE PRACTICE. UNDER NO CIRCUMSTANCES WILL ACTERNA BE LIABLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RELATED TO BREACH OF THIS WARRANTY.

7.5 EQUIPMENT RETURN INSTRUCTIONS

For each piece of equipment returned for repair, attach a tag that includes the following information:

(1) Owner's name, address, and telephone number.

(2) The serial number, product type, and model.

(3) Warranty status. (If you are unsure of the warranty status of your instrument, contact Acterna Customer Service.)

(4) A detailed description of the problem or service requested.

(5) The name and telephone number of the person to contact regarding questions about the repair.

(6) The return authorization (RA) number (US customers), or reference number (European Customers).

If possible, return the equipment using the original shipping container and material. If the original container is not available, the unit should be carefully packed so that it will not be damaged in transit; when needed, appropriate packing materials can be obtained by contacting Acterna Customer Services. Acterna is not liable for any damage that may occur during shipping. The customer should clearly mark the Acterna-issued RA or reference number on the outside of the package and ship it prepaid and insured to Acterna.

INDEX

— Symbols —

% Link Utilization Test Result
fractional HDLC category 3-35
%Error Free Sec Test Result
logic category 2-15

— Numerics —

2209 T1/T1 Field Services Module
getting started 1-4
56K
ISDN PRI call type screen 4-107
64K
ISDN PRI call type screen 4-107

— A —

Abort Printout
print request tab 5-117
Aborted Frames Test Result
fractional HDLC category 3-35
ISDN PRI option 4-110
Acterna Customer Services 7-127
Acterna TestPad 2000
getting started 1-4
Acterna Worldwide Contacts 2-iv
Action Buttons
main screen 2-12
Adaptor Plug
bottom-panel features 1-7
Adding Descriptive Comments to a User-Configured Test
common applications 3-80
Additional Test Results
user interface description 2-18
Advanced Stress Patterns Option
description 1-2
Alarm Criteria
specifications 6-122
Application Icon Selection
main screen 2-9
Application Setup Property Sheets
operation 2-19
Applications
adding descriptive comments to a user-configured test 3-80
CSU emulation 3-42
DS1 monitor test from DS3 3-85
DS3 loopback BER test 3-83
in-service DS1 timing slips analysis 3-40
ISDN PRI option 4-94
monitoring A/B/C/D signaling bits 3-32
monitoring fractional HDLC statistics 3-33
monitoring T1 performance 3-25
monitoring VF 3-36
PBX/switch emulation (originating a call) 3-48
PBX/switch emulation (terminating a call) 3-51
programmable code configuration 3-88
repeater commands for loop code tests 3-59
saving results on a PCMCIA card 3-82
saving tests on a PCMCIA card 3-77
signaling monitor (call capture) 3-46
signal-to-noise ratio (SNR) measurements 3-37
T1 drop and insert setup (place call) 3-52
T1 loopback BER test 3-27
T1 loopback test from a DSX-1 3-29
testing intelligent repeater spans 3-55
TestPad Intelligent Test configuration 3-65
transmitting VF tones from a DSX-1 3-39
user configured test 3-70
User-Configured Test Configuration 3-71
user-programmable loop codes and patterns 3-88
using a PCMCIA card with TestMATE 3-77
using TestMATE 3-64
using TestPad Intelligent Test 3-64
using VT100 emulation 3-60
AUX Functions Softkey
description 2-11

— B —

Battery
- access door 1-7
- Low LED 1-5
- operation 2-23
- recharging 2-24
- removal and replacement 2-23

Battery Status Softkey
- description 2-11

B-Channel Selection
- ISDN PRI call type screen 4-107

Bit Error Rate Test Result
- logic category 2-14

Bit Errors Test Result
- logic category 2-14

Bottom-Panel Features
- getting started 1-6

BPV Erred Secs Test Result
- BPV category 2-15

BPV Errors Test Result
- BPV category 2-15

BPV Rate Test Result
- BPV category 2-15

BPV Results Category
- description 2-15

— C —

C Msg (dBrnc) Test Result
- SNR results 3-38

C Notch (dBrnc) Test Result
- SNR results 3-38

Call 1
- ISDN PRI result screens 4-109

Call 1 Connected Test Result
- ISDN PRI option 4-110

Call 2
- ISDN PRI result screens 4-109

Call Fail Count Test Result
- ISDN PRI option 4-110

Call Failure Test Result
- ISDN PRI option 4-110

Call Type
- ISDN PRI call type screen 4-106

Called Number
- ISDN PRI call type screen 4-107

Calling Number
- ISDN PRI call type screen 4-107

Charging LED
- front-panel features 1-5

Checking for Available Options 2-11

Choosing an Application
- operation 2-21

Clear Buffer
- print request tab 5-117

Comment Item Variables
- TestMATE 3-81

Common Applications 3-25
- adding descriptive comments to a user-configured test 3-80
- CSU emulation 3-42
- DS1 monitor test from DS3 3-85
- DS3 loopback BER test 3-83
- in-service DS1 timing slips analysis 3-40
- monitoring A/B/C/D signaling bits 3-32
- monitoring fractional HDLC statistics 3-33
- monitoring T1 performance 3-25
- monitoring VF 3-36
- PBX/switch emulation (originating a call) 3-48
- PBX/switch emulation (terminating a call) 3-51
- programmable code configuration 3-88
- repeater commands for loop code tests 3-59
- saving results on a PCMCIA card 3-82
- saving test on a PCMCIA card 3-77
- signaling monitor (call capture) 3-46
- signal-to-ratio measurements 3-37
- T1 drop and insert setup (place call) 3-52
- T1 loopback BER test 3-27
- T1 loopback test from a DSX-1 3-29
- testing intelligent repeater spans 3-55
- TestPad Intelligent Test configuration 3-65
- transmitting VF tones from a DSX-1 3-39
- user configured test 3-70
- user-configured test configuration 3-71
- user-programmable loop codes and patterns 3-88

using a PCMCIA card with TestMATE 3-77
using TestMATE 3-64
using TestPad Intelligent Test 3-64
using VT100 emulation 3-60
Configuration Variables
TestMATE 3-80
Configure Primary
ISDN PRI test type setup screen 4-106
Configure Secondary
ISDN PRI test type setup screen 4-106
Connections
printer 1-8
printer setup 5-115
RX jack
DS3 1-8
primary T1 1-5
secondary T1 1-6
TX jack
DS3 1-8
primary T1 1-5
secondary T1 1-6
Connectors
DS3 option specifications 6-123
Controls Print
print request tab 5-117
CRC Erred Frames Test Result
fractional HDLC category 3-35
CRC Erred Sec Test Result
frame category 2-16
CRC Error Rate Test Result
frame category 2-16
CRC Errors Test Result
frame category 2-16
CRC SES Test Result
frame category 2-16
CSU Emulation
common applications 3-42
Customer Service Locations 7-127

— D —

D Chan Select
ISDN PRI test type setup screen 4-106
Date Test Result
time category 2-18
D-Channel Backup Testing
supported features of terminate mode PRI
ISDN PRI option 4-103
D-Channel Ready Test Result
ISDN PRI option 4-110
Description
instrument 1-4
user interface 2-9
Discarded Frames Test Result
fractional HDLC category 3-35
DS1 Alarm Criteria
specifications 6-122
DS1 Monitor Test from DS3
common applications 3-85
DS1 Specifications 6-119
DS3 Analysis Option
battery operation 2-23
description 1-3
DS1 monitor test from DS3 3-85
DS3 loopback BER test 3-83
DS3 Loopback BER Test
common applications 3-83
DS3 Measurements
specifications 6-124
DS3 Option Specifications 6-123
DS3 Rx and Tx Jacks
top-panel features 1-8
Dual Test Results Display
main screen 2-13
Dual-PCMCIA Card Door/Slot
top-panel features 1-8

— E —

Electrical Characteristics
specifications 6-119
Environmental Characteristics
specifications 6-119
Equipment Return Instructions
service and repair information 7-132

Error Free Sec Test Result
logic category 2-15
Error Sec Test Result
logic category 2-15
Errored Frames Test Result
ISDN PRI option 4-110

— F —

Features
bottom-panel 1-6
getting started
front-panel 1-5
top-panel 1-7
File Headings
TestMATE 3-79
Fractional HDLC Option
description 1-3
monitoring fractional HDLC statistics 3-34
Fractional-T1 Option
description 1-2
Frame Count Test Result
fractional HDLC category 3-35
ISDN PRI option 4-110
Frame Erred Secs Test Result
frame category 2-16
Frame Error Rate Test Result
frame category 2-16
Frame Errors Test Result
frame category 2-16
Frame Loss Secs Test Result
frame category 2-16
Frame Losses Test Result
frame category 2-15
Frame Reject Frames Test Result
ISDN PRI option 4-110
Frame Results Category
description 2-15
Frame SES Test Result
frame category 2-16
Frame Slips Test Result
signal category 2-17
Framing Formats
DS3 option specifications 6-123
Front-Panel Features
getting started 1-5
FT1 Testing
T1 loopback BER test 3-27
Functional Applications
ISDN PRI option 4-94

— G —

General Specifications 6-119
Getting Started 1-1
Group LEDs
status/alarm
front-panel features 1-6

— H —

H0
ISDN PRI call type screen 4-107
Handset Jack
bottom-panel features 1-7
Help (?) Softkey
description 2-11

— I —

ILE Option
testing intelligent repeater spans 3-55
Input Specifications 6-119
In-Service DS1 Timing Slips Analysis
common applications 3-40
Installing and Replacing Battery 2-23
Instrument Description 1-4
Instrument Service 7-127
Intelligent Line Equipment Option
description 1-3
Interface Description
user 2-9
Interface Selection

ISDN PRI call type screen 4-107
Invalid Frames Test Result
ISDN PRI option 4-110
ISDN PRI Call Setting Pop-up Dialog Box
ISDN PRI call settings menu
ISDN PRI option 4-107
ISDN PRI Call Settings Menu
ISDN PRI option 4-106
ISDN PRI Call Type Screen
ISDN PRI call settings menu
ISDN PRI option 4-106
ISDN PRI Cause Codes
ISDN PRI test results 4-111
ISDN PRI Option 4-93
ISDN PRI Status Messages
ISDN PRI test results 4-110
ISDN PRI Summary Screen
ISDN property sheets and menus
ISDN PRI option 4-104
ISDN PRI Test Results
ISDN PRI option 4-108
ISDN PRI Test Type Setup Screen
ISDN property sheets and menus
ISDN PRI option 4-105
ISDN Property Sheets and Menus
ISDN PRI option 4-104
ISDN Setup Property Screen
ISDN property sheets and menus
ISDN PRI option 4-104

— L —

LAPD Multi-Frame Loss Test Result
ISDN PRI option 4-110
LAPD Protocol Errors Test Result
ISDN PRI option 4-110
LCD
front-panel features 1-6
LED Results Category
description 2-18
LEDs
battery low
front-panel features 1-5
status/alarm group 1-6
Level (dBm) Test Result
SNR results 3-38
Level dBdsx Test Result
signal category 2-17
Level dBm Test Result
signal category 2-17
Level Vpp Test Result
signal category 2-17
Line Coding
DS3 option specifications 6-123
Logic Results Category
description 2-14
Loop Codes
transmitted output specifications 6-121
Loop Codes Detection Criteria
input specifications 6-120

— M —

Main Screen
operation 2-9
Manual Overview 1-1
Measurement Specifications 6-121
Measurements
signal-to-noise ratio 3-37
Measuring Simplex Current 2-17
Measuring Timing Slips 2-17
Message Display
main screen 2-13
Microphone
front-panel features 1-5
Monitor Mode for ISDN PRI Calls
ISDN PRI option 4-94
Monitoring A/B/C/D Signaling Bits
common applications 3-32
Monitoring Fractional HDLC Statistics
common applications 3-33
Monitoring T1 Performance
common applications 3-25

Monitoring VF
common applications 3-36

— N —

National-Specific Cause Codes
ISDN PRI test results 4-112
NFAS Capability
supported features of terminate mode PRI
ISDN PRI option 4-101
Nickel-Metal Hydride (NiMH) battery
removing 2-23
Non-Octet Frames Test Result
fractional HDLC category 3-35
Nx56K
ISDN PRI call type screen 4-107
Nx64K
ISDN PRI call type screen 4-107

— O —

Operation 2-9
battery 2-23
Options 1-2
advanced stress patterns 1-2
checking for available option 2-11
DS3 analysis 1-3
fractional HDLC 1-3
fractional-T1 1-2
intelligent line equipment 1-3
primary rate interface ISDN 1-3
signaling 1-3
TestMATE 1-3
VF PCM TIMS 1-2
VT100 emulation 1-3
Output Specifications 6-120
Overview
manual 1-1

— P —

Patt Loss Sec Test Result
logic category 2-14
Pattern Losses Test Result
logic category 2-14
Pattern Synchronization Detection Criteria
input specifications 6-120
Patterns
DS3 option specifications 6-123
PBX/Switch Emulation (Originating a Call)
common applications 3-48
PBX/Switch Emulation (Terminating a Call)
common applications 3-51
Permanent Softkeys
main screen 2-11
Physical Characteristics
specifications 6-119
Place Call and Receive Call
supported features of terminate mode PRI
ISDN PRI option 4-98
Placing An ISDN PRI Call to TPI 560P
ISDN PRI option 4-108
Power LED
front-panel features 1-5
Power Switch
bottom-panel features 1-7
Primary Rate Interface ISDN Option
applications 4-93
description 1-3
functional applications 4-94
ISDN PRI call settings menu 4-106
ISDN PRI test results 4-108
ISDN property sheets and menus 4-104
monitor mode for ISDN PRI calls 4-94
placing an ISDN PRI call to TPI 560P 4-108
specifications 4-93
supported features of terminate mode PRI 4-98
terminate mode for ISDN PRI calls 4-97
Primary RX & TX Jacks
front-panel features 1-5
Primary RX Jack
measuring timing slips 2-17
Primary/Secondary
ISDN PRI result screens 4-109
Print Options Property Sheet 5-118

Print Options Tab
printer property sheet 5-118
Print Request Property Sheet
printer operation 5-116, 5-118
Print Request Tab
printer property sheet 5-116
Printer Access Control
printer setup 5-115
Printer Connection
printer setup 5-115
Printer Connector
top-panel features 1-8
Printer Operation 5-115
Printer Property Sheet
printer operation 5-116
Printer Settings Property Sheet 5-117
printer operation 5-117
Printer Settings Tab
printer property sheet 5-117
Printer Setup
printer operation 5-115
Printer Setup Softkey
description 2-11
Product Enhancement Group
customer services 7-128
Programmable Code Configuration
common applications 3-88
Property Sheet
setup summary 2-19
tabs set test parameters 2-20
Property Sheet Tabs Set Test Parameters
operation 2-20
Property Tabs Behind Summary Sheet
operation 2-22

— Q —

Quick Configuration Softkeys
main screen 2-11

— R —

Receive Byte Test Result
SNR results 3-38
Receiver (Single)
DS3 option specifications 6-123
Recharging Battery 2-24
Reject Frames Test Result
ISDN PRI option 4-110
Repeater Commands for Loop Code Tests
common applications 3-59
Replacement
battery removal and 2-23
RESTART Softkey
description 2-11
Results Category Descriptions
user interface description 2-14
Results CATEGORY Display
main screen 2-12
Results GROUP Display
main screen 2-12
Results Print
print request tab 5-116
Return Instructions
equipment 7-132
Rx Frequency Test Result
signal category 2-17
RX Jack
front-panel
primary T1 connection 1-5
secondary T1 connection 1-6
input specifications 6-119
measuring simplex current 2-17
measuring timing slips 2-17
Rx Jack
top-panel
DS3 connection 1-8

— S —

Saving Results on a PCMCIA Card
common applications 3-82

Saving Tests on a PCMCIA Card
common applications 3-77
Screen Contrast Softkey
description 2-11
Secondary RX & TX Jacks
front-panel features 1-6
Secondary RX Jack
measuring timing slips 2-17
Services 7-127
Setup Message Display
main screen 2-13
Setup Summary Property Sheet
operation 2-19
Signal Loss Secs Test Result
signal category 2-17
Signal Losses Test Result
signal category 2-17
Signal Results Category
description 2-16
Signaling Monitor (Call Capture)
common applications 3-46
Signaling Option
description 1-3
PBX/switch emulation (originating a call) 3-48
PBX/switch emulation (terminating a call) 3-51
signaling monitor (call capture) 3-46
T1 drop and insert setup (place call) 3-52
Signal-To-Noise Ratio (SNR) Measurements
common applications 3-37
Simplex Curr mA Test Result
signal category 2-17
Slip Analysis Secs Test Result
signal category 2-17
SNR (dB) Test Result
SNR results 3-38
Speaker
front-panel features 1-5
Specifications 6-119
DS1 6-119
DS1 alarm criteria 6-122
DS3 option 6-123
general 6-119
input 6-119
ISDN PRI Option 4-93
output 6-120
Status/Alarm Group LEDs 1-6
Status/Alarm LEDs
top-panel features 1-8
Stylus
front-panel features 1-6
Summary Results Category
description 2-14
Supported Features of Terminate Mode PRI
ISDN PRI option 4-98
Switch
ISDN PRI test type setup screen 4-106

— T —

T1 Drop and Insert Setup (Place Call)
common applications 3-52
T1 Loopback BER Test
common applications 3-27
FT1 testing 3-27
T1 Loopback Test From a DSX-1
common applications 3-29
Technical Training
customer services 7-129
Terminate Mode for ISDN PRI Calls
ISDN PRI option 4-97
Test Patterns
advanced stress patterns option 1-2
common applications 3-88
Test Results
BPV 2-15
dual test results display 2-13
fractional HDLC 3-35
frame 2-15
ISDN PRI cause codes 4-111
ISDN PRI national-specific cause codes 4-112
ISDN PRI results 4-110
ISDN PRI status messages 4-110
LED 2-18
logic 2-14
restarting 2-11

results category descriptions 2-14
results CATEGORY display 2-12
results GROUP display 2-12
saving on a PCMCIA card 3-82
signal 2-16
signal-to-noise ratio 3-38
summary 2-14
time 2-18
traffic 2-17

Test Seconds Test Result
time category 2-18

Test State/Status Message Display
main screen 2-13

Test Systems Field Engineering and Installation
customer services 7-129

Testing Intelligent Repeater Spans
common applications 3-55

TestMATE Option
description 1-3
selecting function 2-9
user configured test 3-70
using TestMATE 3-64

TestPad Intelligent Test Configuration
common applications 3-65

Time Results Category
description 2-18

Time Test Result
time category 2-18

Timing Slips Test Result
signal category 2-17

Top-Panel Features
getting started 1-7

Traffic CH # Test Result
traffic category 2-18

Traffic Results Category
description 2-17

Transmitted Loop Codes
output specifications 6-121

Transmitter (Single)
DS3 option specifications 6-123

Transmitting VF Tones from a DSX-1
common applications 3-39

TX Jack
front-panel
primary T1 connection 1-5
secondary T1 connection 1-6
output specifications 6-120

Tx Jack
top-panel
DS3 connection 1-8

— U —

User Configured Test
common applications 3-70

User Interface Description 2-9

User-Configured Test Configuration
common applications 3-71

User-Programmable Loop Codes and Patterns
common applications 3-88

Using a PCMCIA Card with TestMATE
common applications 3-77

Using TestMATE
common applications 3-64

Using Testpad Intelligent Test
common applications 3-64

Using the 2209
operation 2-20

Using VT100 Emulation
common applications 3-60

— V —

VF Frequency (Hz) Test Result
SNR results 3-38

VF PCM TIMS Option
description 1-2
monitoring VF 3-36
transmitting VF tone from a DSX-1 3-39

VOICE
ISDN PRI call type screen 4-107

VT100 Emulation Option
description 1-3
selecting function
AUX functions softkey 2-11

using VT100 emulation 3-60

— W —

Warranty Information 7-130

www.manualsplus.com
1033361

ACTERNA™
The Keepers of Communications

Global Headquarters
20400 Observation Drive
Germantown, Maryland 20876-4023 USA
Toll Free 1-800-638-2049 • Tel +1-301-353-1550 • Fax +1-301-444-8468
www.acterna.com

15392D